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System And Method For Receiver Resource Allocation and Verification
GOUNALIS, Anthony J.
Serial No.: 10/675,132
Docket No.: L0562.70042US00

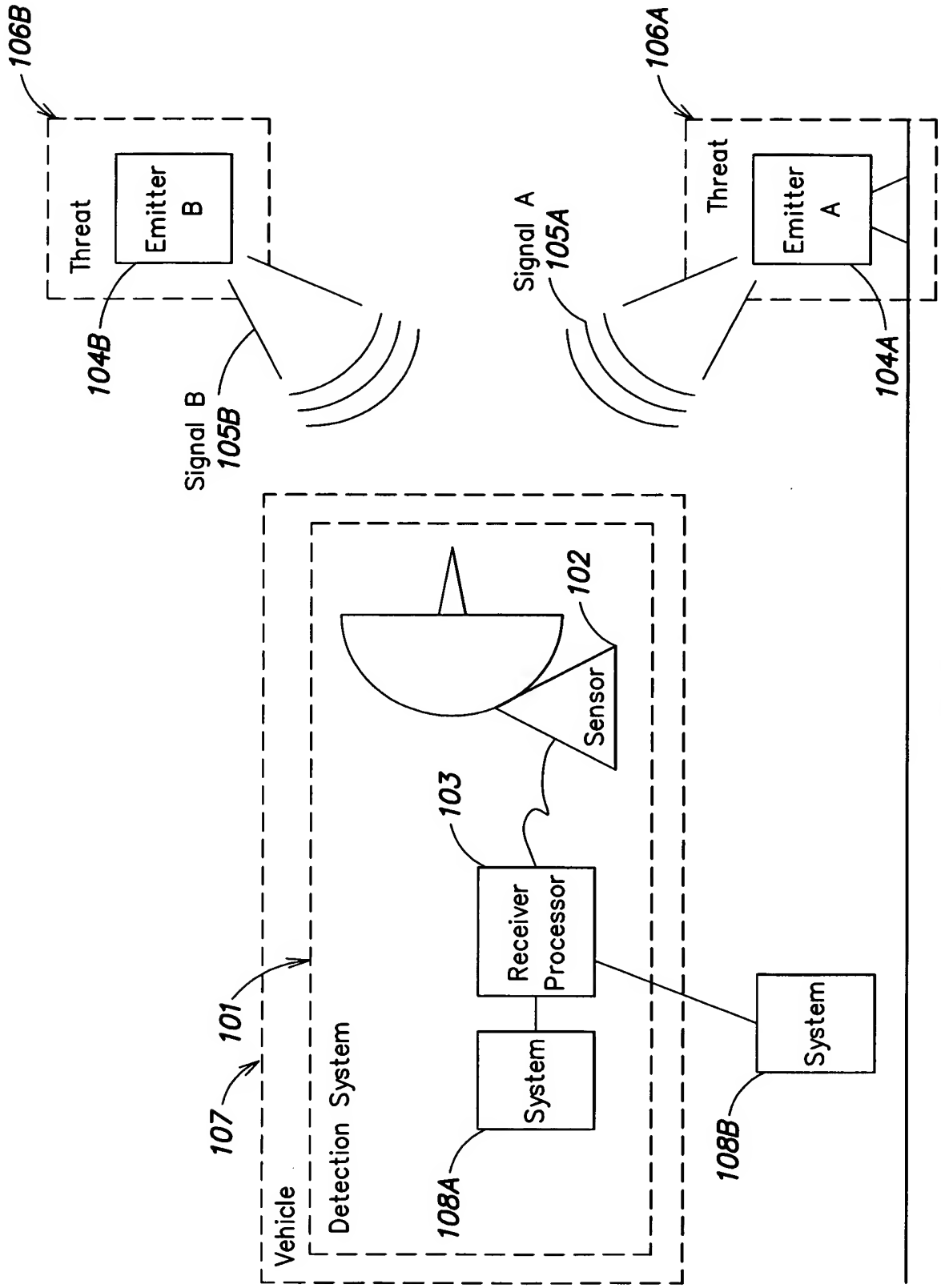

FIG. 1

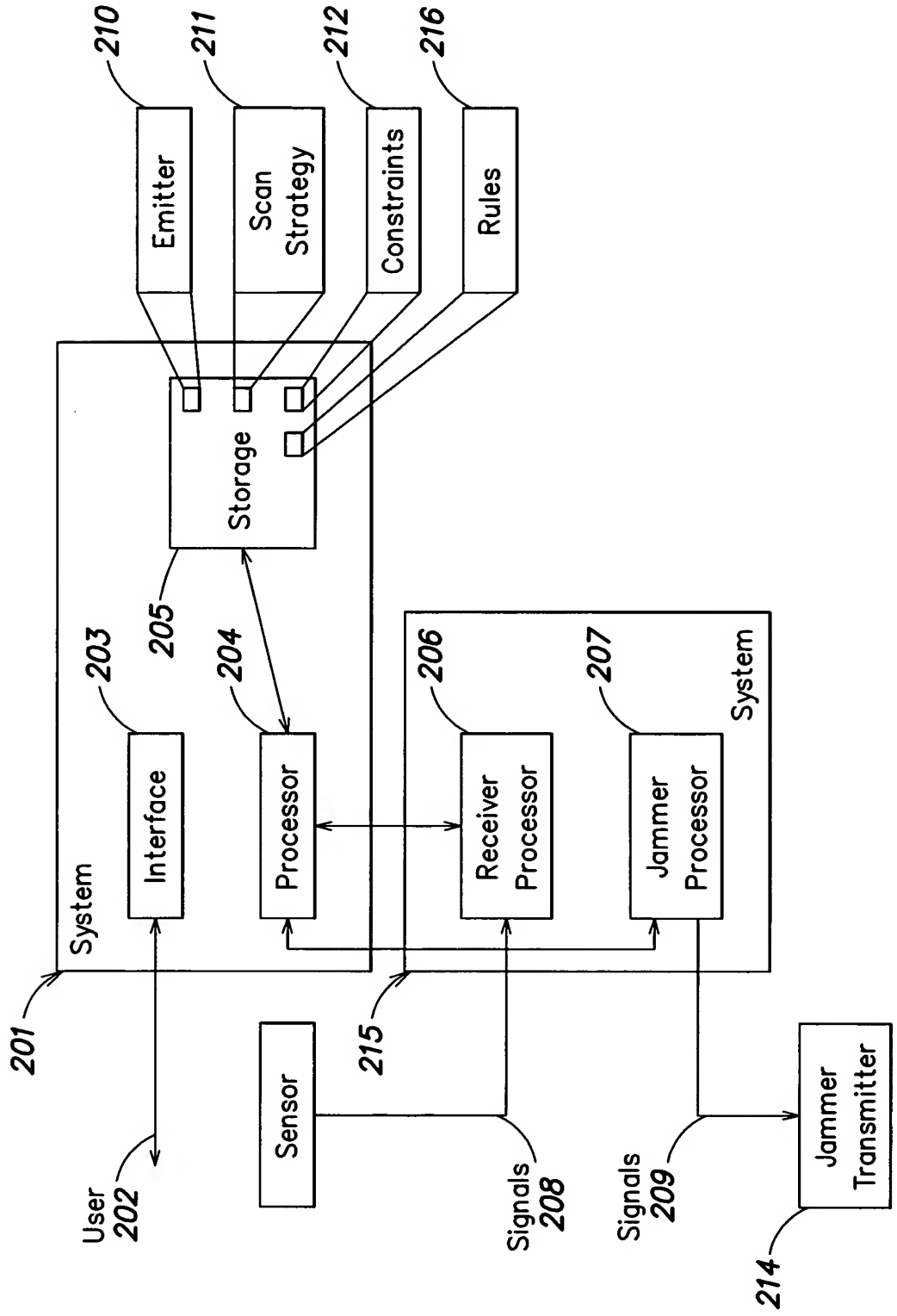
210
211
212
216
Emitter
Scan Strategy
Constraints
Rules
Storage
205
203
204
206
207
System
Interface
Processor
Receiver Processor
Jammer Processor
System
201
215
Sensor
User 202
Signals 208
Signals 209
Jammer Transmitter
214

FIG. 2

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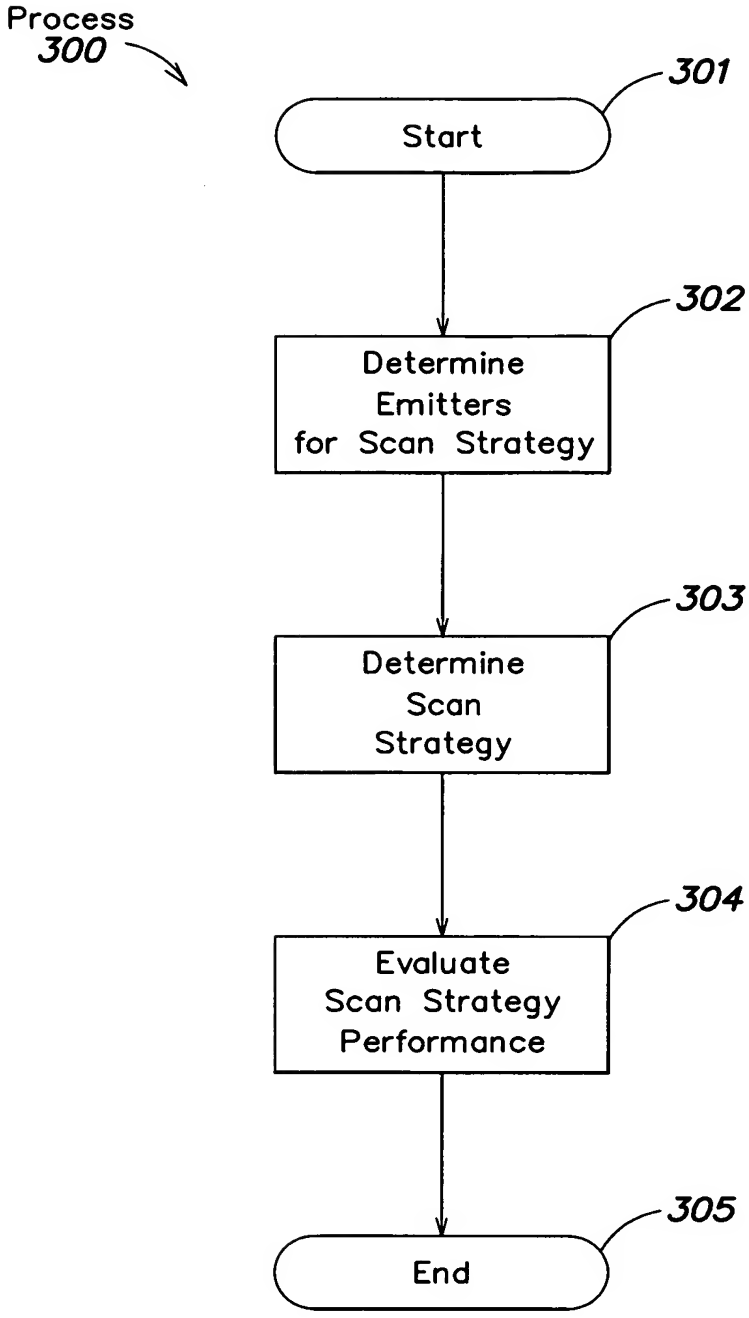

FIG. 3

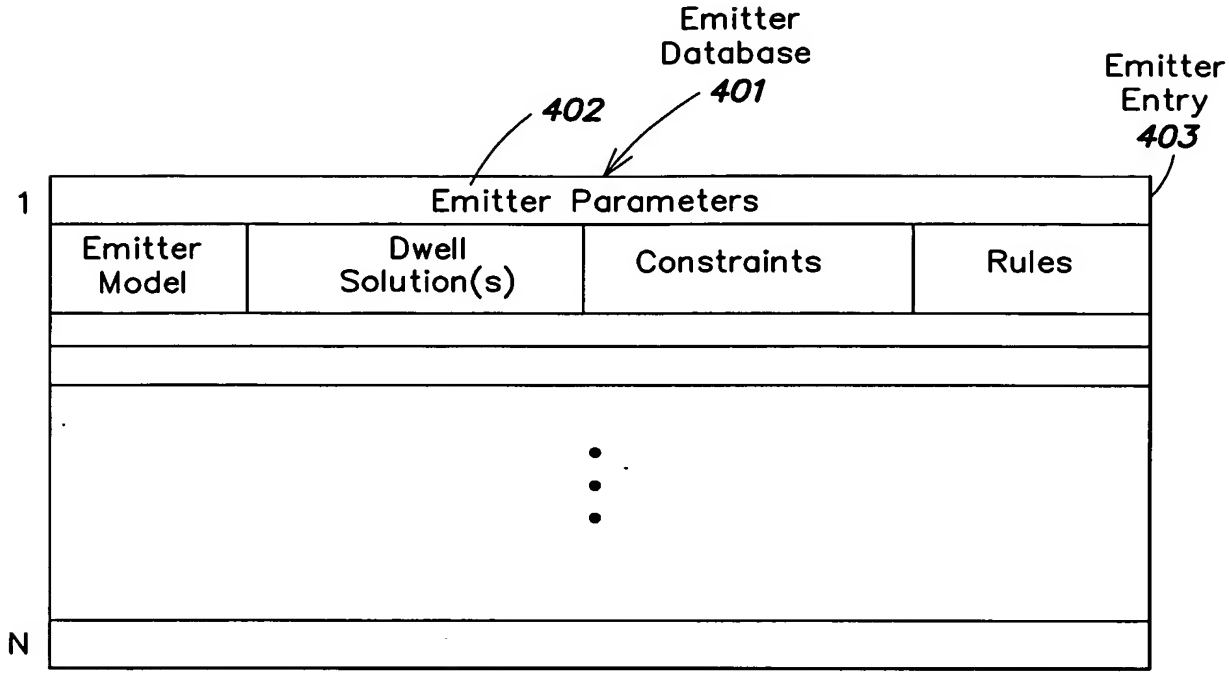
Emitter
Database
401
402
Emitter
Entry
403
1
Emitter Parameters
Emitter
Model
Dwell
Solution(s)
Constraints
Rules
N

FIG. 4

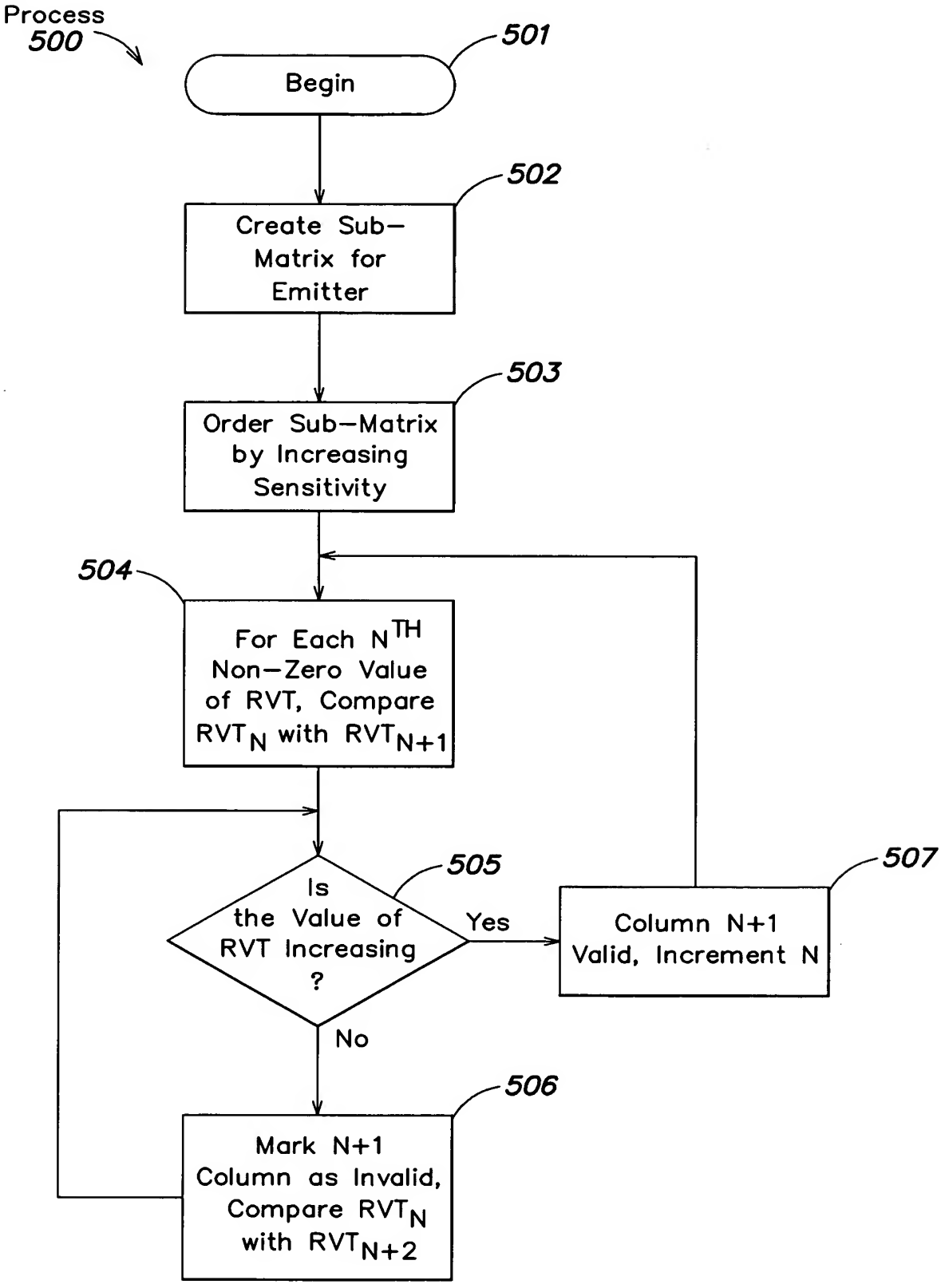
Process
500
501
Begin
502
Create Sub-Matrix for Emitter
503
Order Sub-Matrix by Increasing Sensitivity
504
For Each N^TH Non-Zero Value of RVT, Compare RVT_N with RVT_N+1
505
Is the Value of RVT Increasing ?
Yes
507
Column N+1 Valid, Increment N
No
506
Mark N+1 Column as Invalid, Compare RVT_N with RVT_N+2

FIG. 5

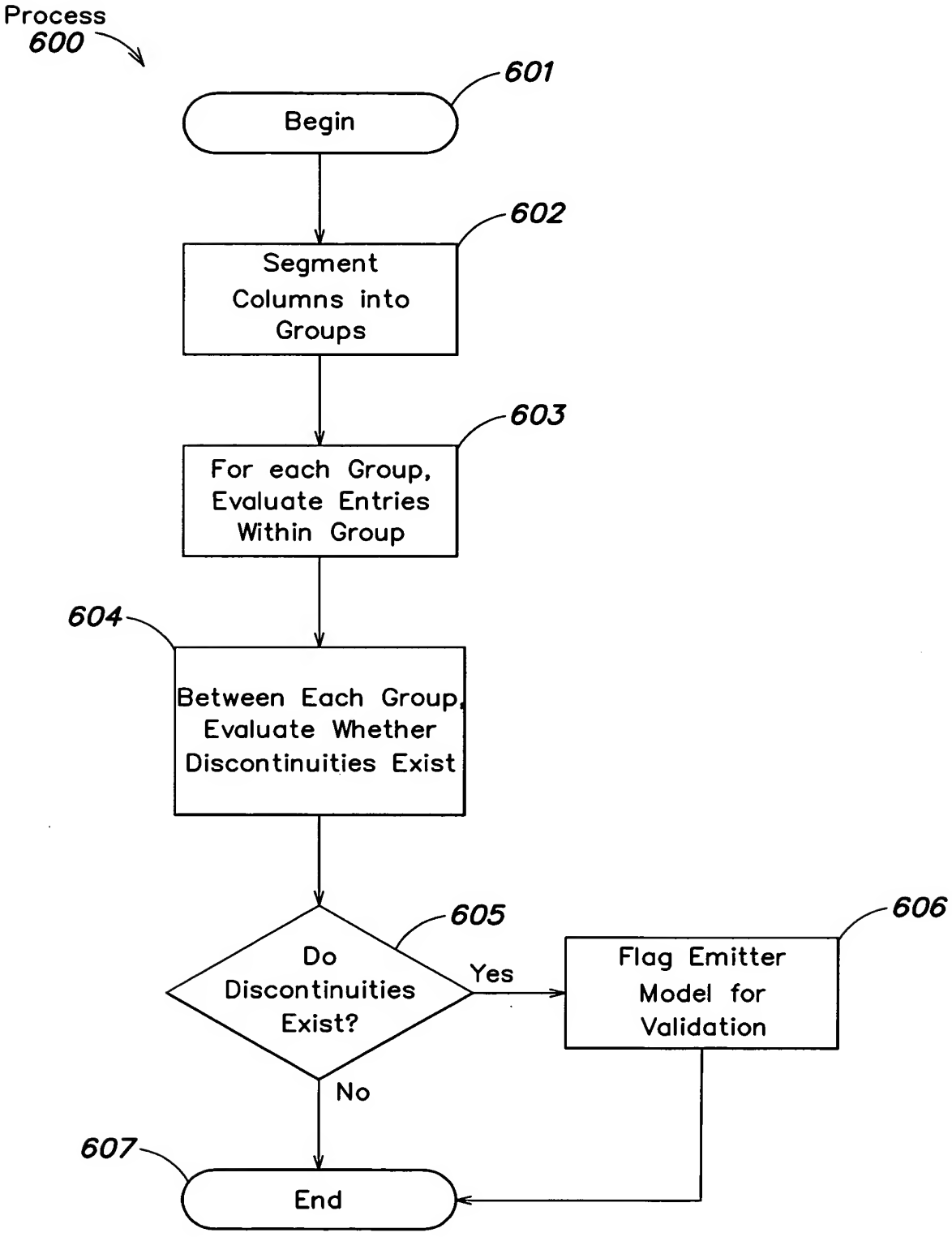
Process
600
601
Begin
602
Segment Columns into Groups
603
For each Group, Evaluate Entries Within Group
604
Between Each Group, Evaluate Whether Discontinuities Exist
605
Do Discontinuities Exist?
Yes
606
Flag Emitter Model for Validation
No
607
End

FIG. 6

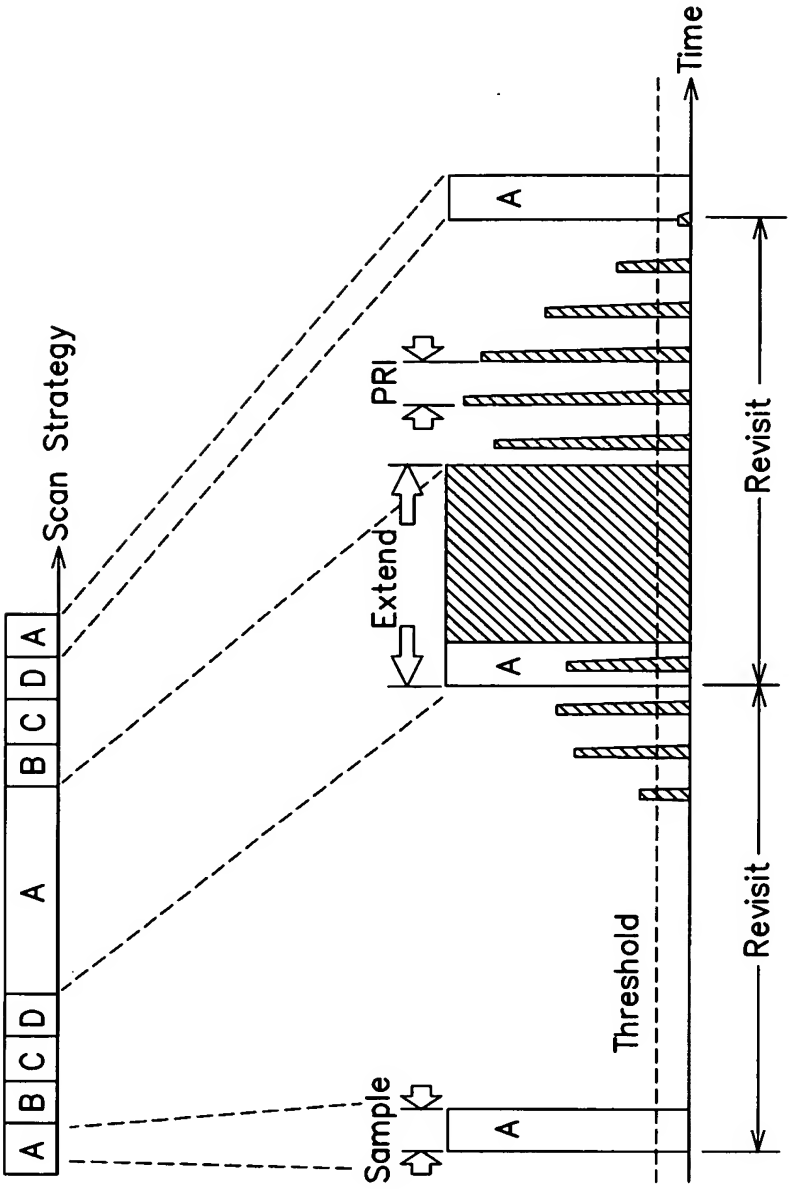
Scan Strategy
A
B
C
D
A
D
C
B
A
Time
A
PRI
Extend
A
Revisit
Threshold
Revisit
Sample
A

FIG. 7

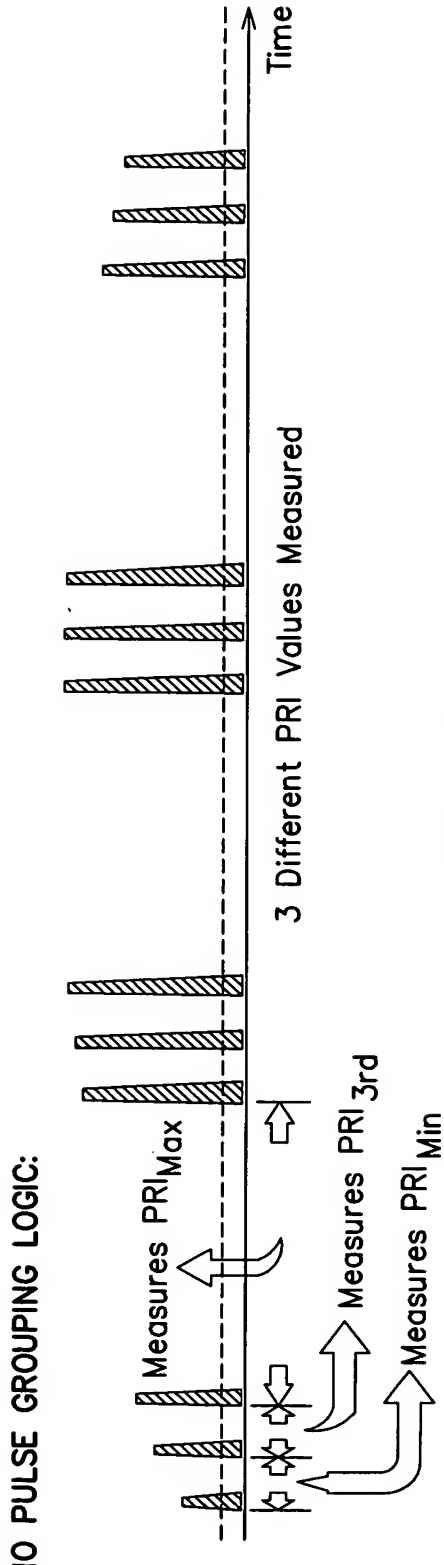
NO PULSE GROUPING LOGIC:
Time
3 Different PRI Values Measured
Measures PRI Max
Measures PRI 3rd
Measures PRI Min

FIG. 8A

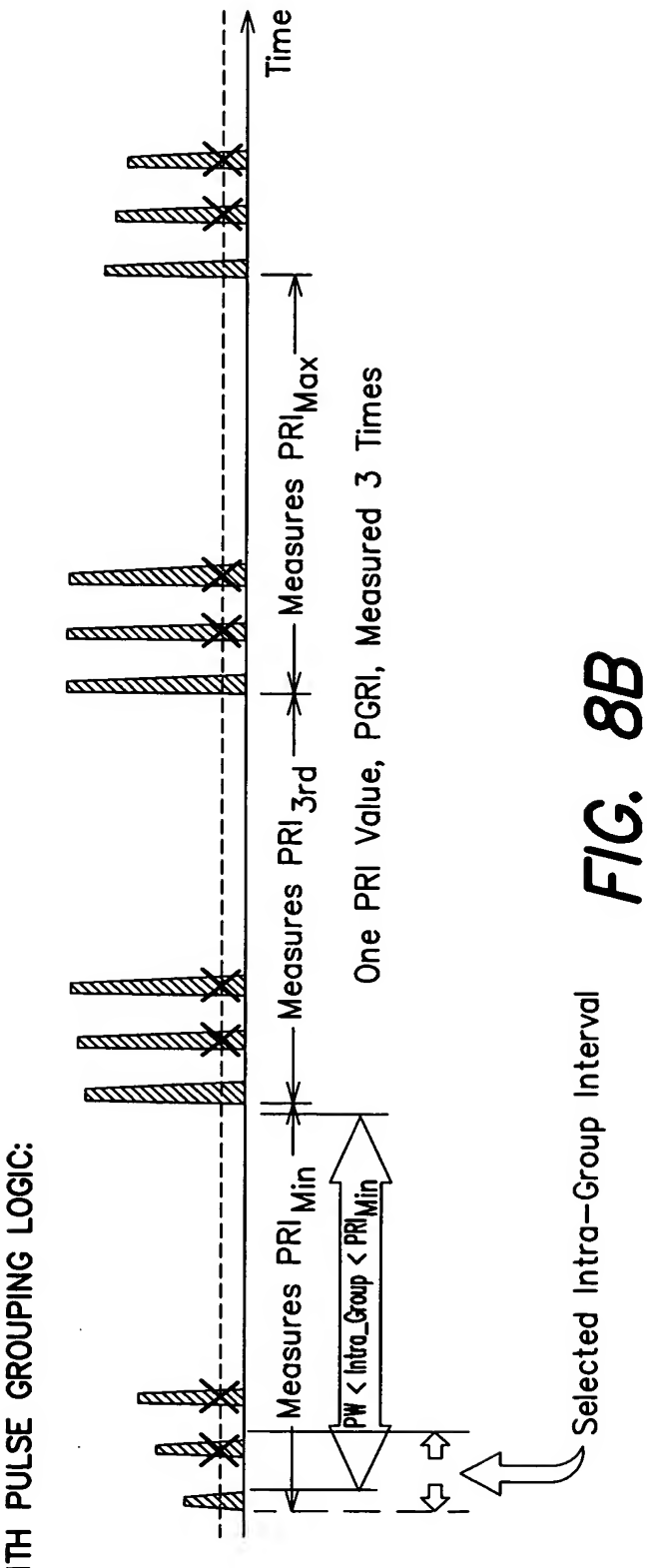
WITH PULSE GROUPING LOGIC:
Time
Measures PRI Min
Measures PRI 3rd
Measures PRI Max
One PRI Value, PGRI, Measured 3 Times
PW < Intra_Group < PRI Min
Selected Intra-Group Interval

FIG. 8B

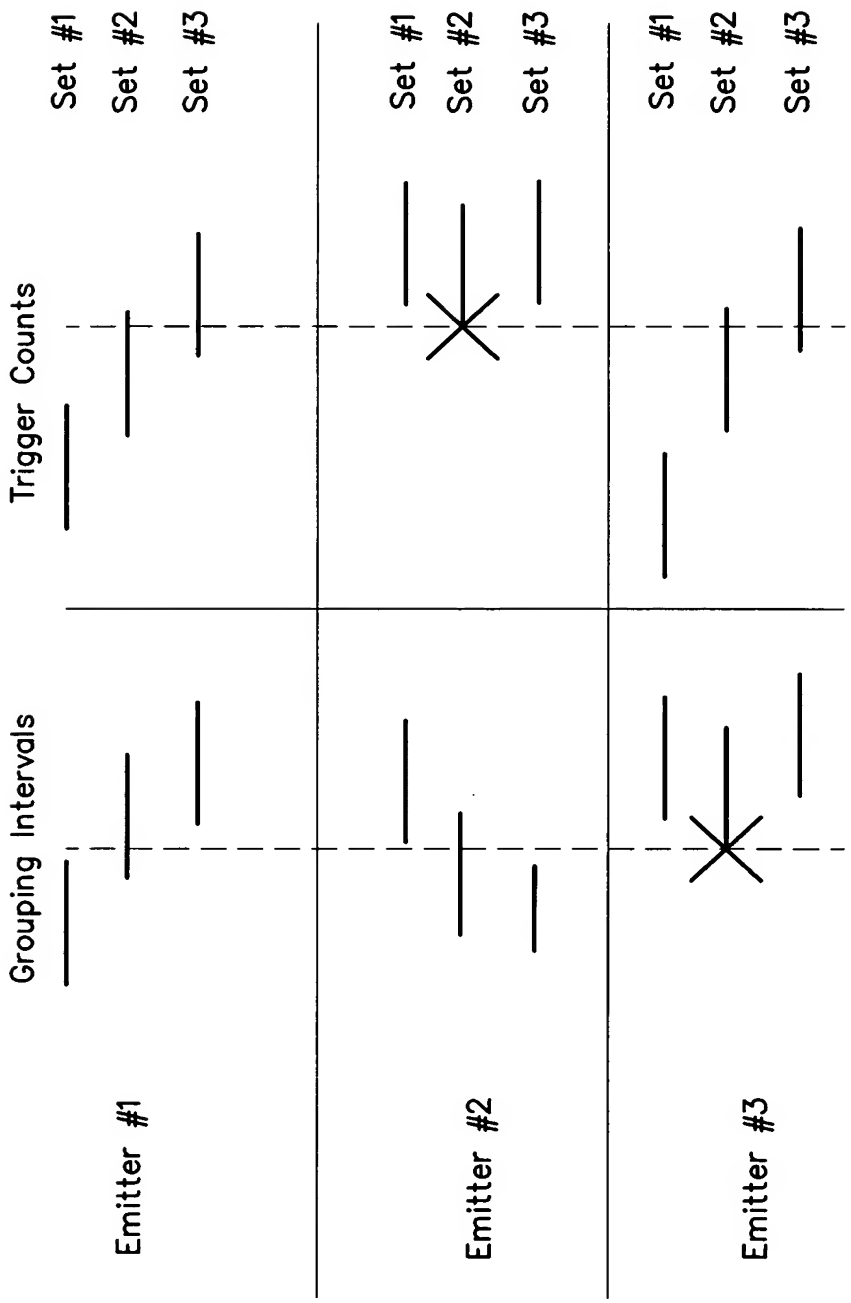
Grouping Intervals
Trigger Counts
Emitter #1
Emitter #2
Emitter #3
Set #1
Set #2
Set #3
Set #1
Set #2
Set #3
Set #1
Set #2
Set #3

FIG. 9

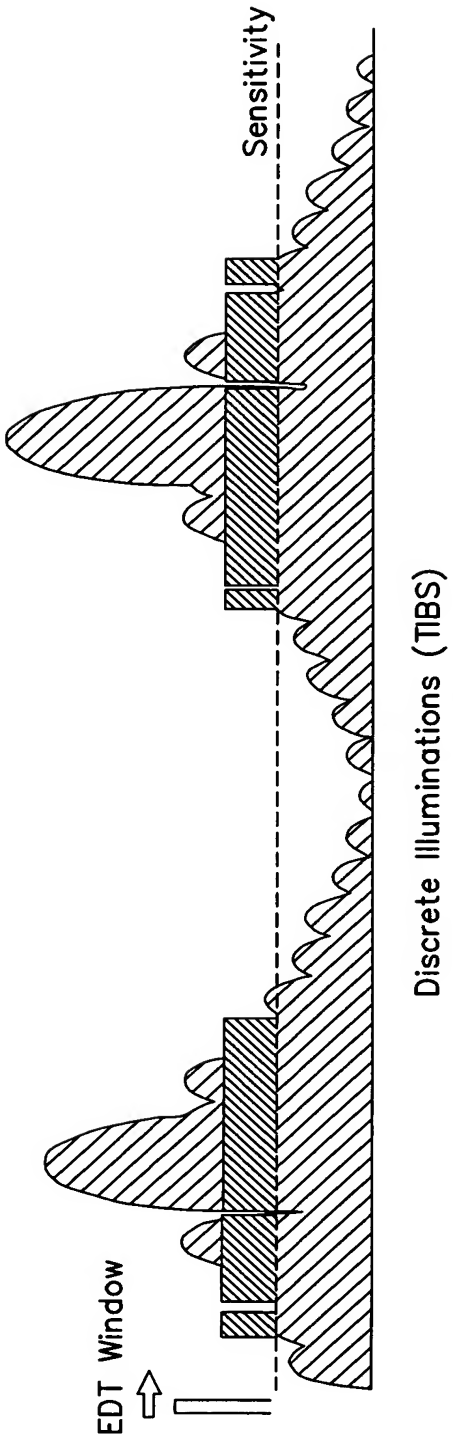

FIG. 10A

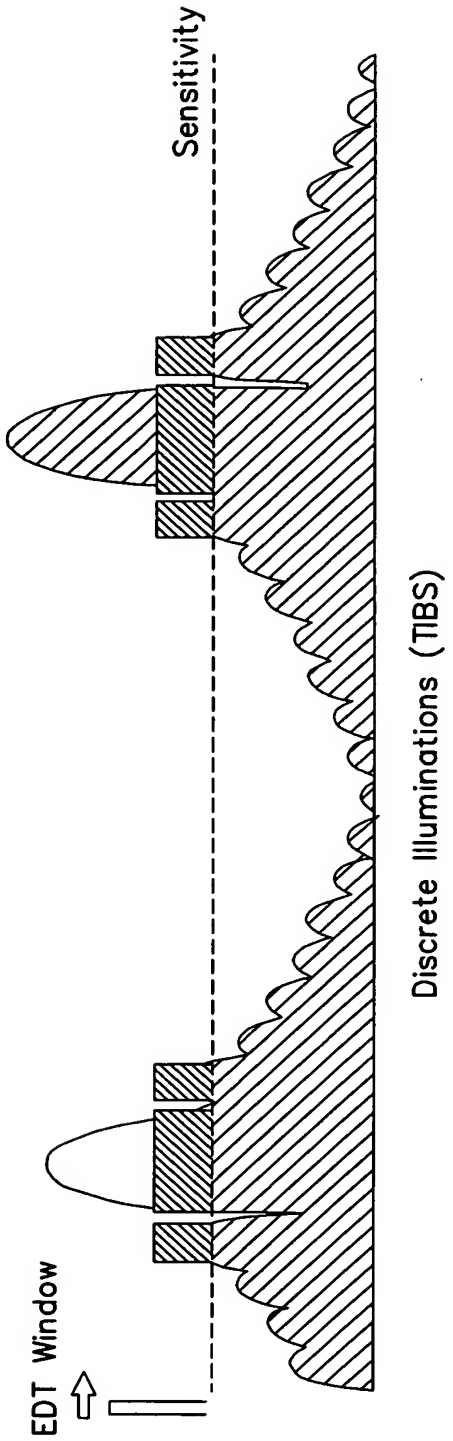

FIG. 10B

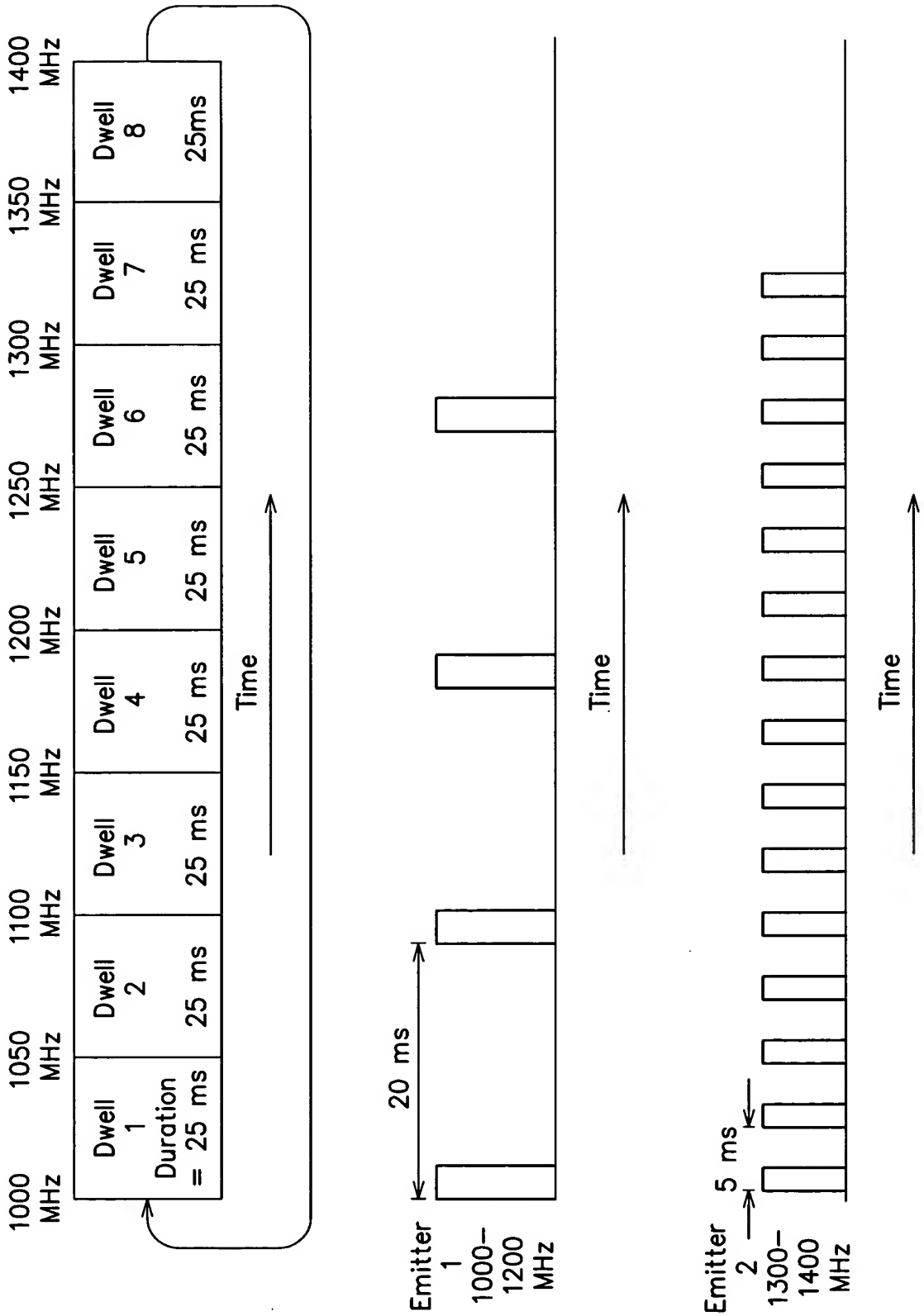
1000 MHz
1050 MHz
1100 MHz
1150 MHz
1200 MHz
1250 MHz
1300 MHz
1350 MHz
1400 MHz
Dwell 1
Duration = 25 ms
Dwell 2
25 ms
Dwell 3
25 ms
Dwell 4
25 ms
Dwell 5
25 ms
Dwell 6
25 ms
Dwell 7
25 ms
Dwell 8
25ms
Time
20 ms
Emitter 1
1000–1200 MHz
Time
5 ms
Emitter 2
1300–1400 MHz
Time

FIG. 11

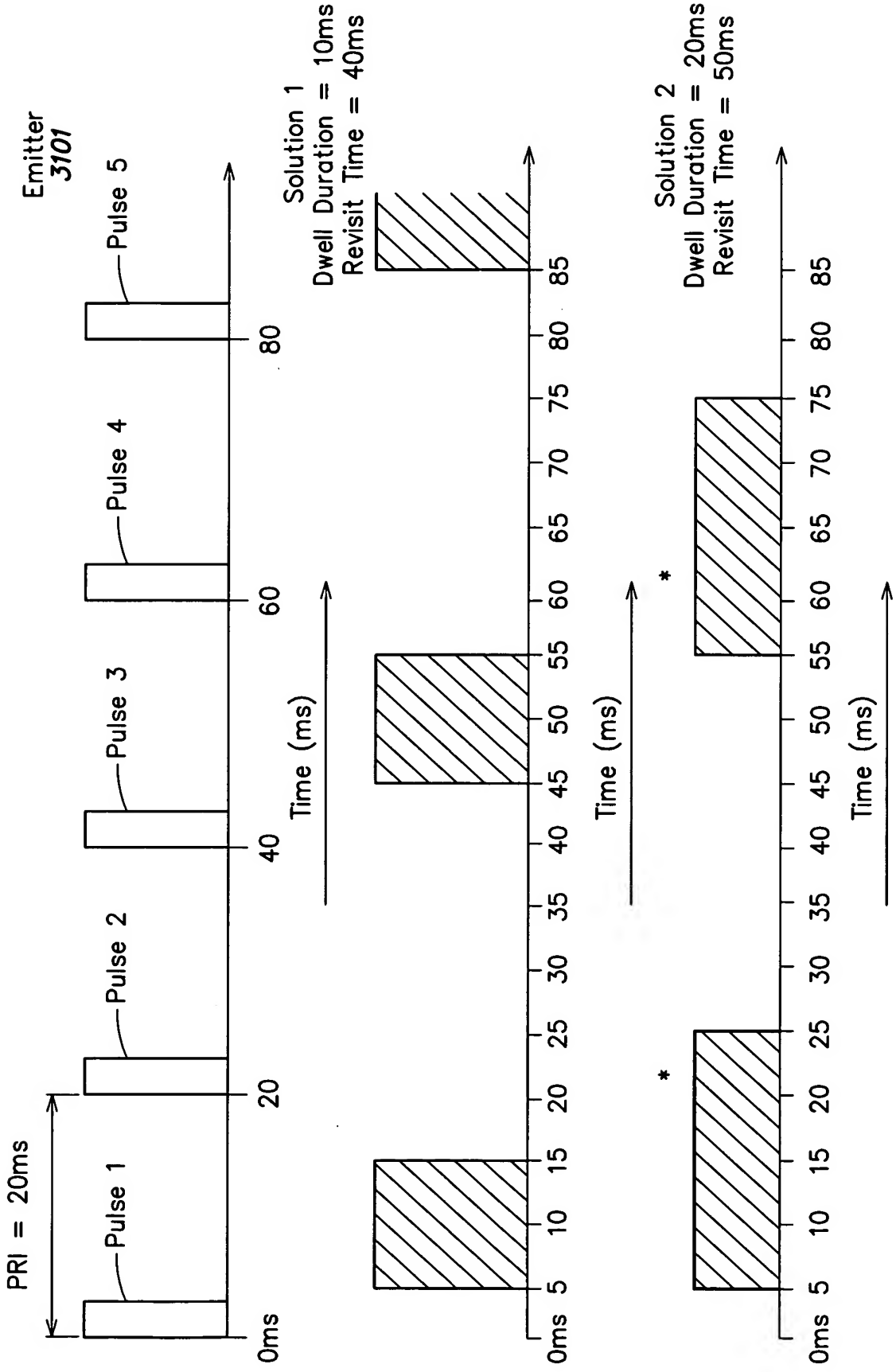
Emitter
3101
PRI = 20ms
Pulse 1
Pulse 2
Pulse 3
Pulse 4
Pulse 5
0ms
20
40
60
80
Time (ms)
Solution 1
Dwell Duration = 10ms
Revisit Time = 40ms
0ms
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
Time (ms)
Solution 2
Dwell Duration = 20ms
Revisit Time = 50ms
0ms
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
Time (ms)

FIG. 12

4000

Emitter Name	Detecting Method 1 250MHz IF/ 15MHz VBW RVT	Detecting Method 2 30MHz IF/ 15MHz VBW RVT	RF Min (MHz)	RF Max (MHz)	Min MDT (ms)
E1	100 ms	650 ms	1000	1300	3
E2	120 ms	780 ms	1220	1350	5
E3	110 ms	330 ms	1510	1810	2
E4	130 ms	390 ms	1730	1860	4

FIG. 13

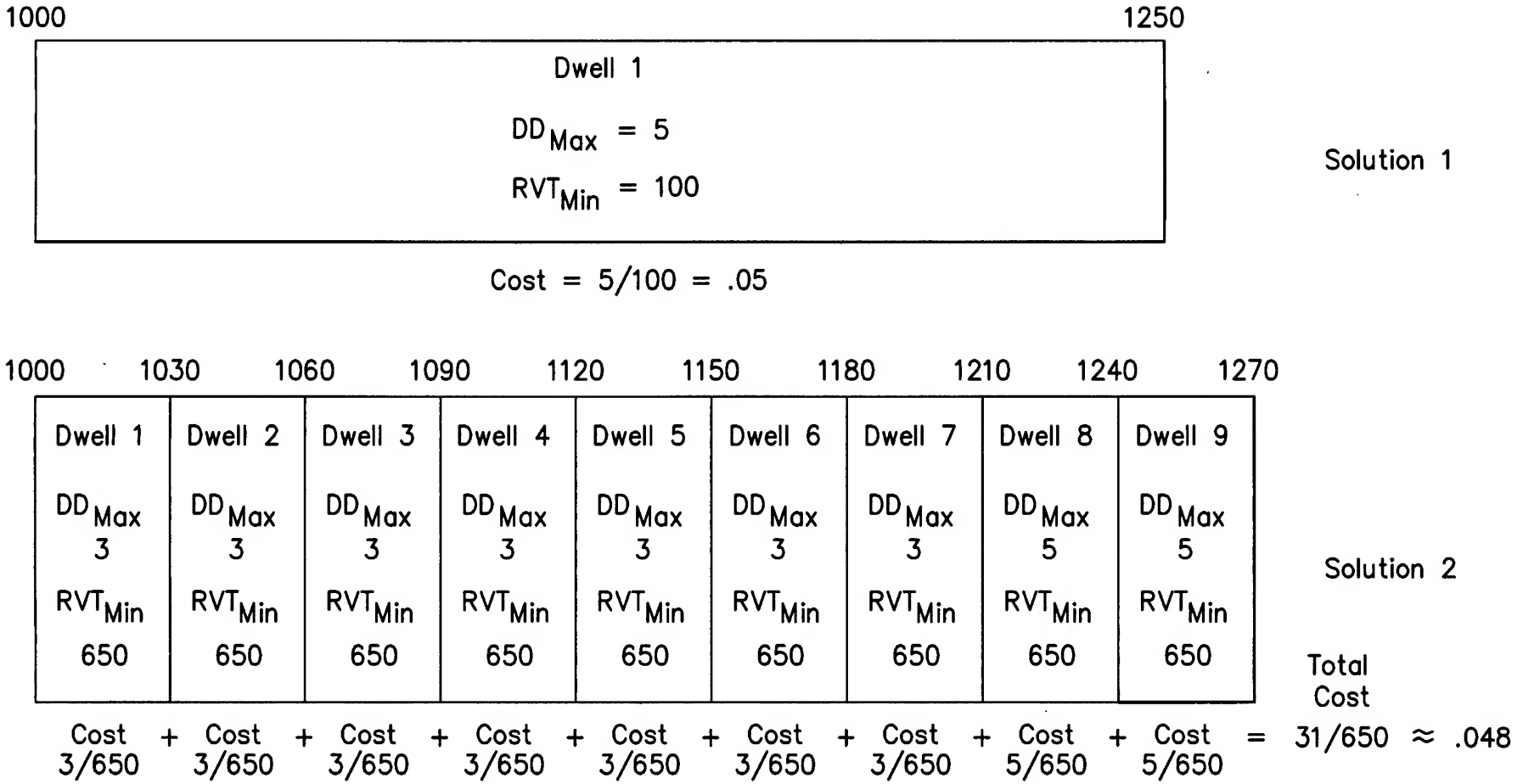
1000
1250
Dwell 1
DD Max = 5
RVT Min = 100
Solution 1
Cost = 5/100 = .05
1000
1030
1060
1090
1120
1150
1180
1210
1240
1270
Dwell 1
DD Max 3
RVT Min 650
Dwell 2
DD Max 3
RVT Min 650
Dwell 3
DD Max 3
RVT Min 650
Dwell 4
DD Max 3
RVT Min 650
Dwell 5
DD Max 3
RVT Min 650
Dwell 6
DD Max 3
RVT Min 650
Dwell 7
DD Max 3
RVT Min 650
Dwell 8
DD Max 5
RVT Min 650
Dwell 9
DD Max 5
RVT Min 650
Solution 2
Cost 3/650 + Cost 3/650 + Cost 3/650 + Cost 3/650 + Cost 3/650 + Cost 3/650 + Cost 3/650 + Cost 5/650 + Cost 5/650 = Total Cost 31/650 ≈ .048

FIG. 14A

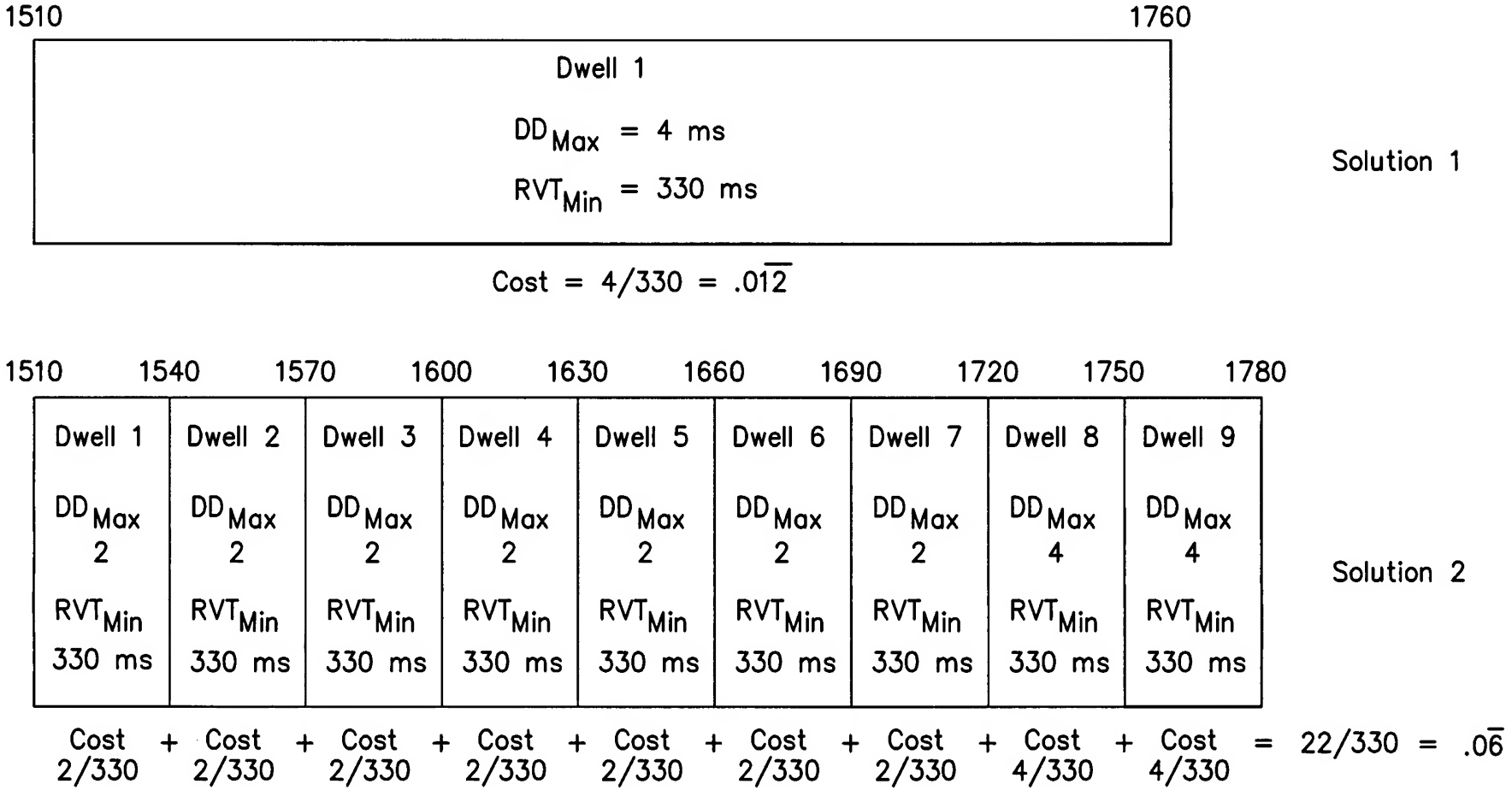

FIG. 14B

System And Method For Receiver Resource Allocation and Verification
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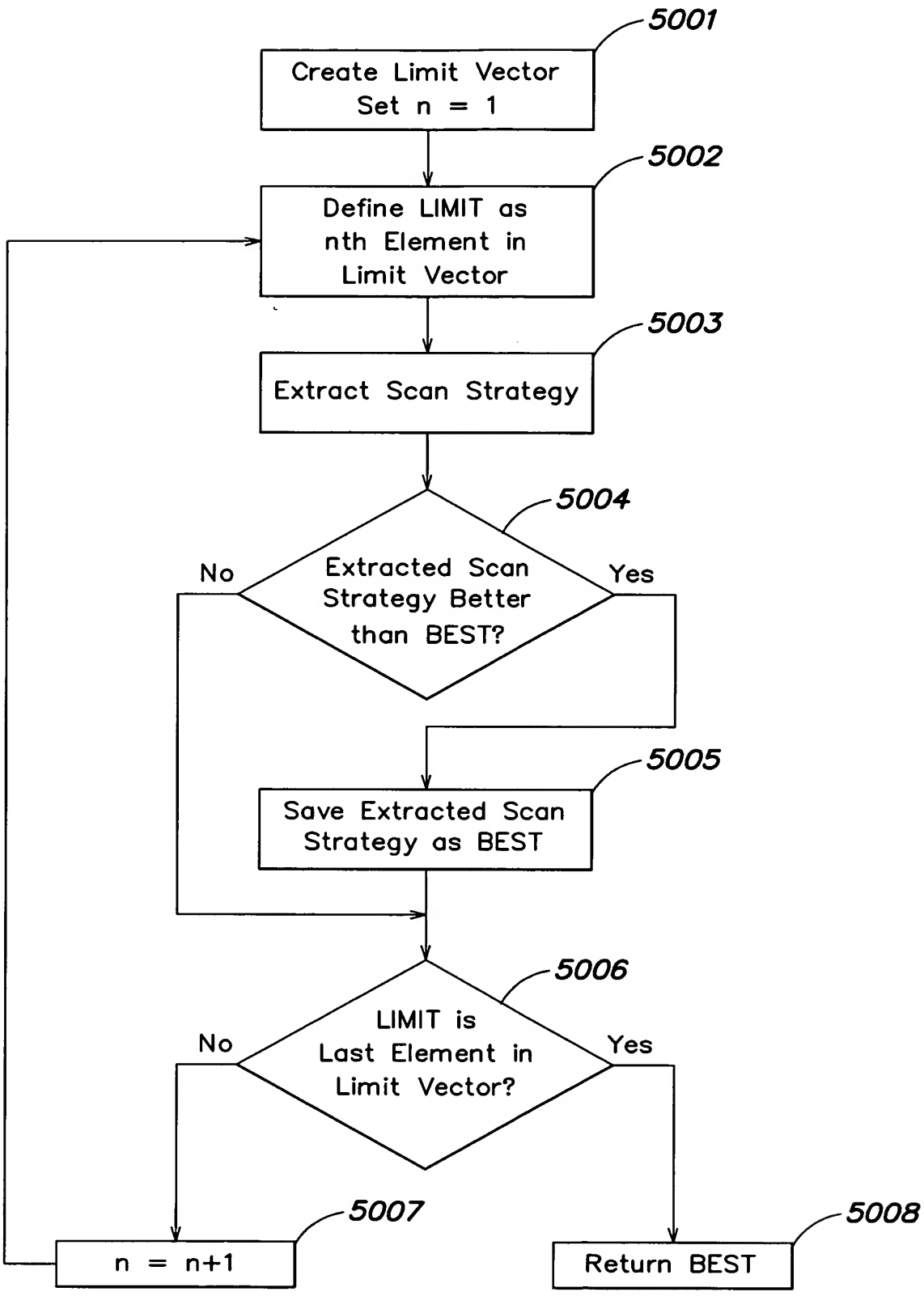
5001
Create Limit Vector
Set n = 1
5002
Define LIMIT as
nth Element in
Limit Vector
5003
Extract Scan Strategy
5004
Extracted Scan
Strategy Better
than BEST?
No
Yes
5005
Save Extracted Scan
Strategy as BEST
5006
LIMIT is
Last Element in
Limit Vector?
No
Yes
5007
n = n+1
5008
Return BEST

FIG. 15

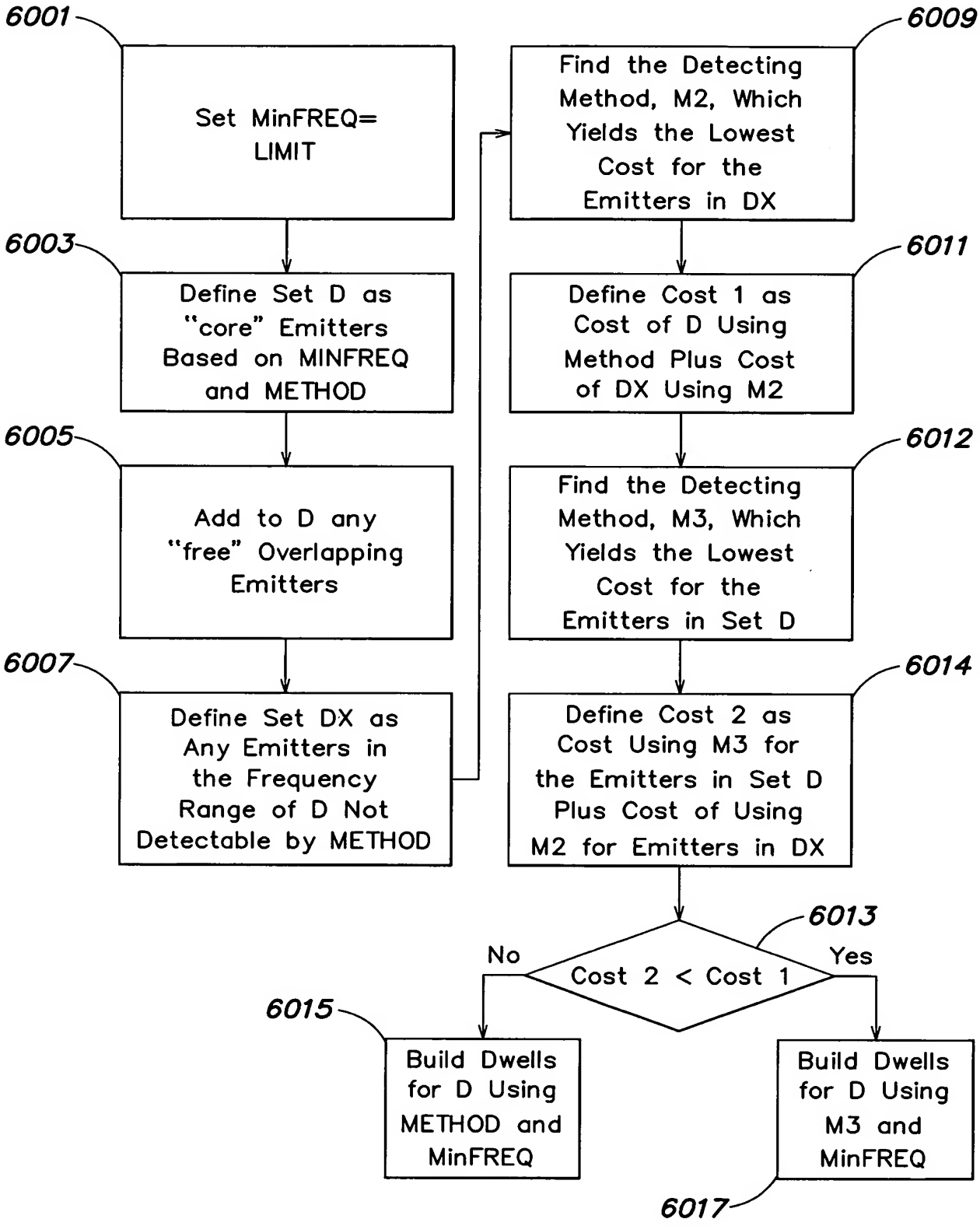
6001
Set MinFREQ= LIMIT
6003
Define Set D as "core" Emitters Based on MINFREQ and METHOD
6005
Add to D any "free" Overlapping Emitters
6007
Define Set DX as Any Emitters in the Frequency Range of D Not Detectable by METHOD
6009
Find the Detecting Method, M2, Which Yields the Lowest Cost for the Emitters in DX
6011
Define Cost 1 as Cost of D Using Method Plus Cost of DX Using M2
6012
Find the Detecting Method, M3, Which Yields the Lowest Cost for the Emitters in Set D
6014
Define Cost 2 as Cost Using M3 for the Emitters in Set D Plus Cost of Using M2 for Emitters in DX
6013
Cost 2 < Cost 1
No
Yes
6015
Build Dwells for D Using METHOD and MinFREQ
6017
Build Dwells for D Using M3 and MinFREQ

FIG. 16

Name	RF Min	RF Max
E1	1100	1200
E2	1150	1250

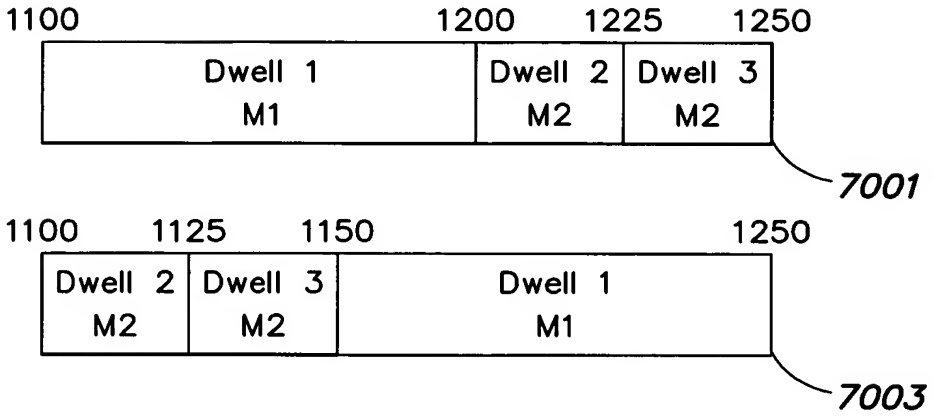

FIG. 17

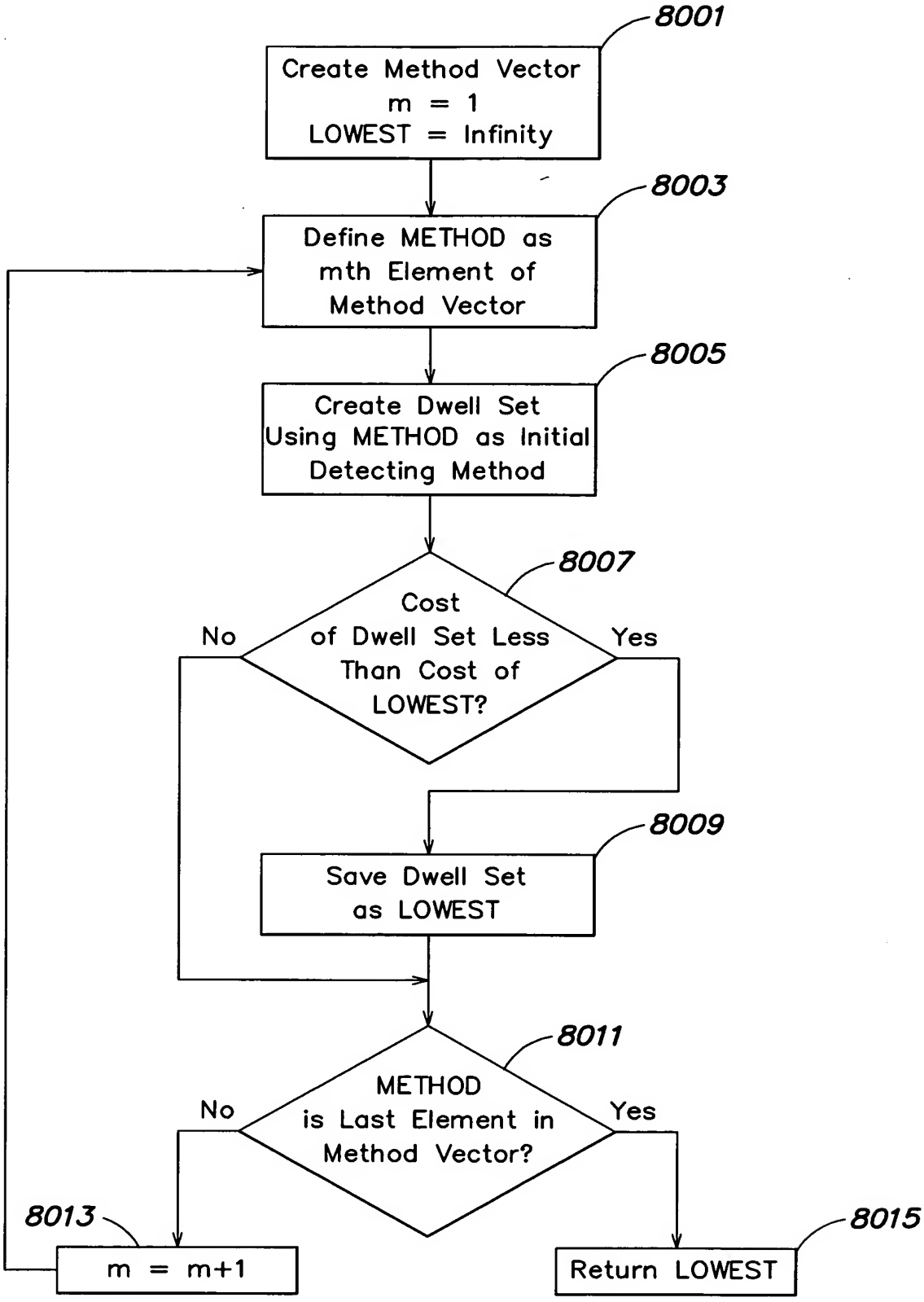
8001
Create Method Vector
m = 1
LOWEST = Infinity
8003
Define METHOD as
mth Element of
Method Vector
8005
Create Dwell Set
Using METHOD as Initial
Detecting Method
8007
Cost
of Dwell Set Less
Than Cost of
LOWEST?
No
Yes
8009
Save Dwell Set
as LOWEST
8011
METHOD
is Last Element in
Method Vector?
No
Yes
8013
m = m+1
8015
Return LOWEST

FIG. 18

Emitter	Dwell Duration (ms)	Revisit Time (ms)
Emitter 1	1	500
Emitter 2	2	1200

FIG. 19

Emitter	Dwell Duration (ms)	Revisit Time (ms)	Cost
Emitter 1	1	500	.002
Emitter 2	5	1000	.005

FIG. 20

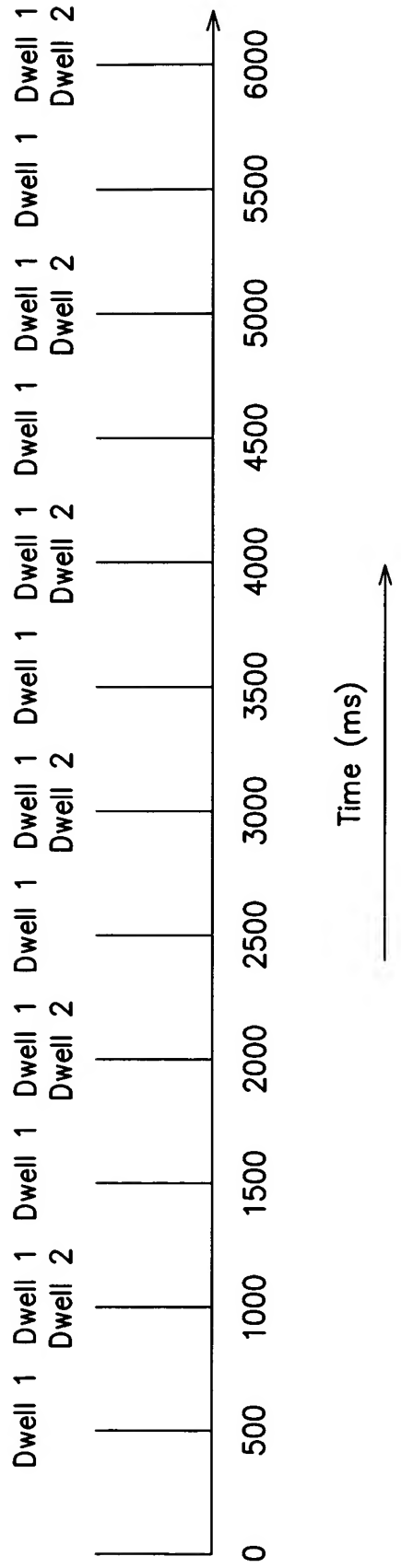
Dwell 1
Dwell 2
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
Time (ms)

FIG. 21

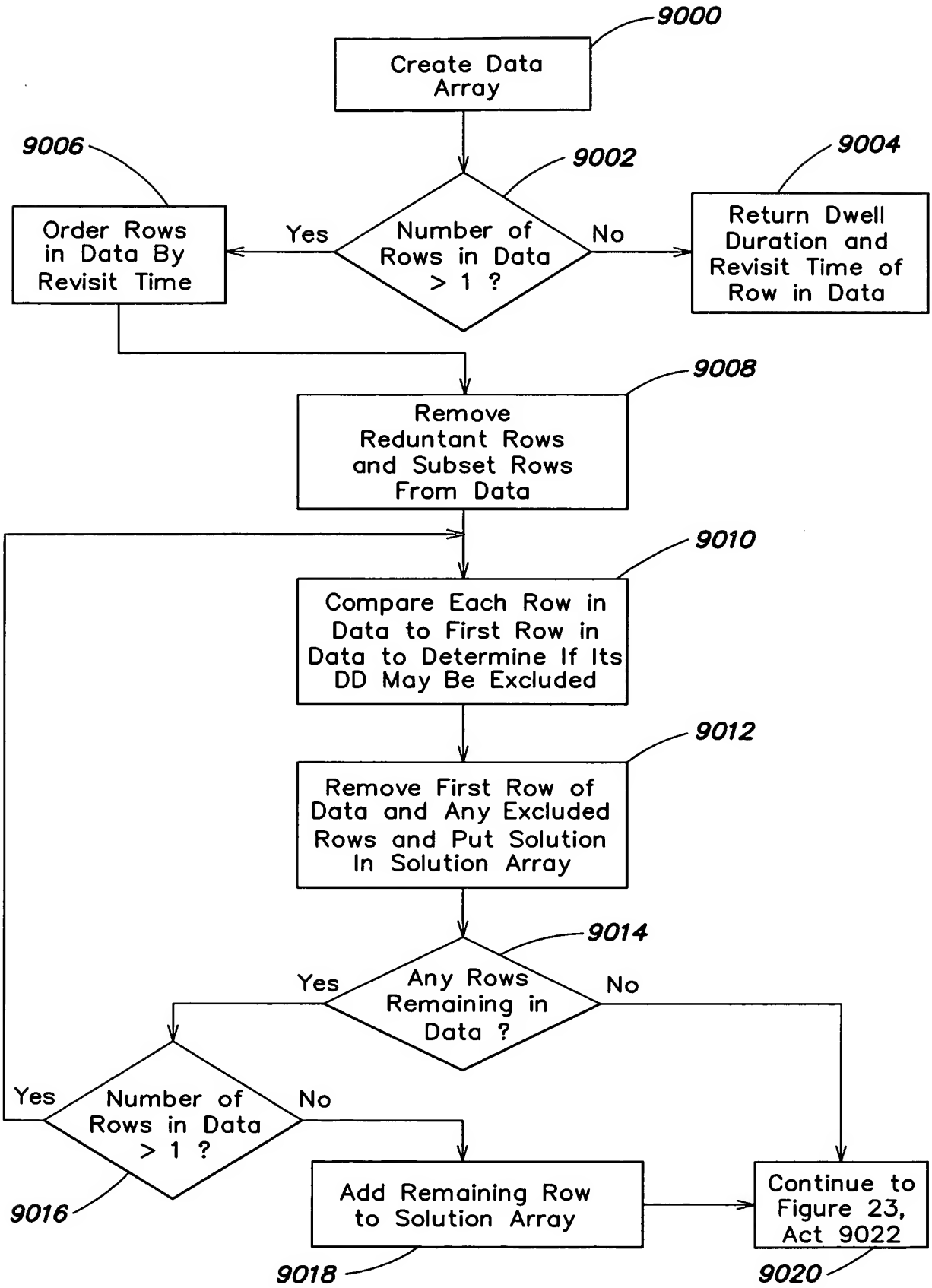
9000
Create Data Array
9002
Number of Rows in Data > 1 ?
Yes
No
9004
Return Dwell Duration and Revisit Time of Row in Data
9006
Order Rows in Data By Revisit Time
9008
Remove Reduntant Rows and Subset Rows From Data
9010
Compare Each Row in Data to First Row in Data to Determine If Its DD May Be Excluded
9012
Remove First Row of Data and Any Excluded Rows and Put Solution In Solution Array
9014
Any Rows Remaining in Data ?
Yes
No
Number of Rows in Data > 1 ?
Yes
No
9016
Add Remaining Row to Solution Array
9018
Continue to Figure 23, Act 9022
9020

FIG. 22

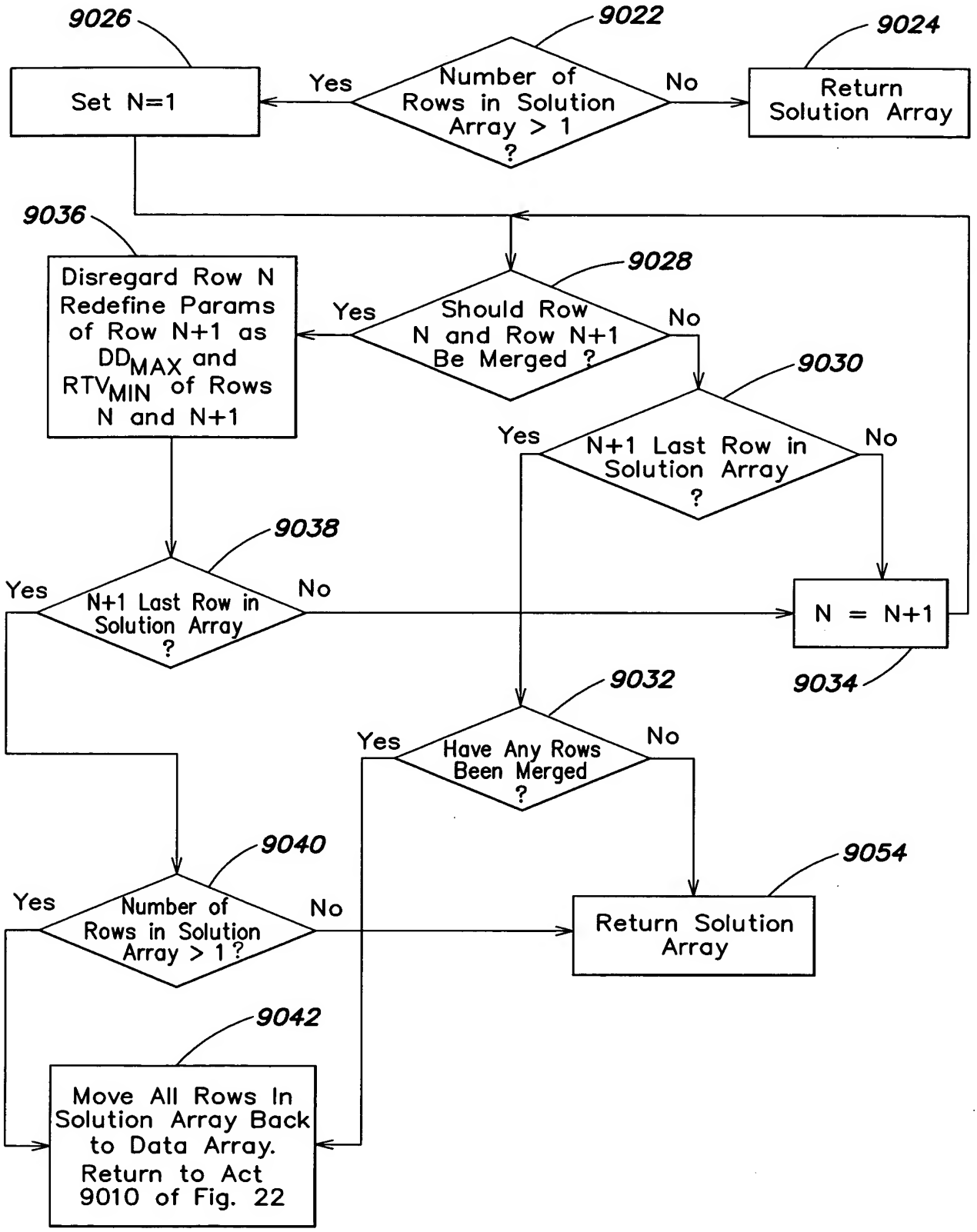
9026
Set N=1
9022
Number of Rows in Solution Array > 1 ?
Yes
No
9024
Return Solution Array
9036
Disregard Row N Redefine Params of Row N+1 as DD_{MAX} and RTV_{MIN} of Rows N and N+1
9028
Should Row N and Row N+1 Be Merged ?
Yes
No
9030
N+1 Last Row in Solution Array ?
Yes
No
9038
N+1 Last Row in Solution Array ?
Yes
No
N = N+1
9034
9032
Have Any Rows Been Merged ?
Yes
No
9040
Number of Rows in Solution Array > 1 ?
Yes
No
9054
Return Solution Array
9042
Move All Rows In Solution Array Back to Data Array. Return to Act 9010 of Fig. 22

FIG. 23

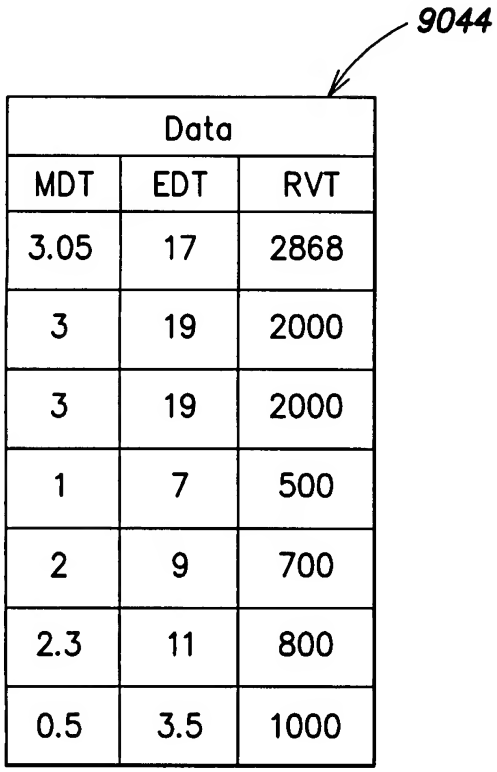

FIG. 24A

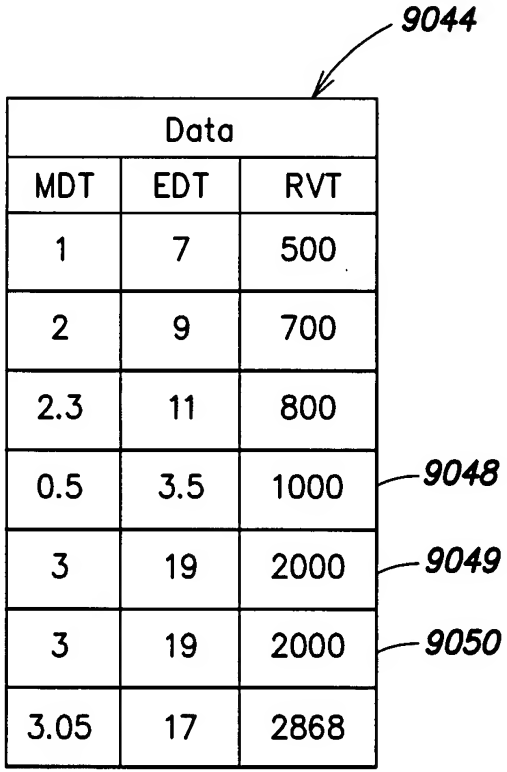

FIG. 24B

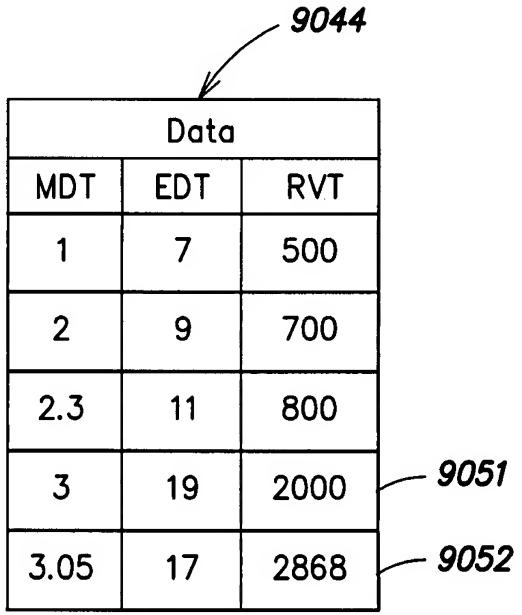

FIG. 24C

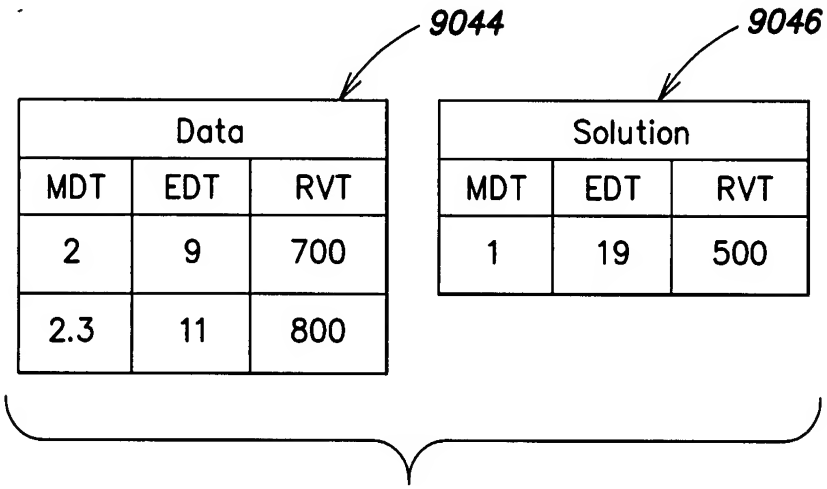

FIG. 24D

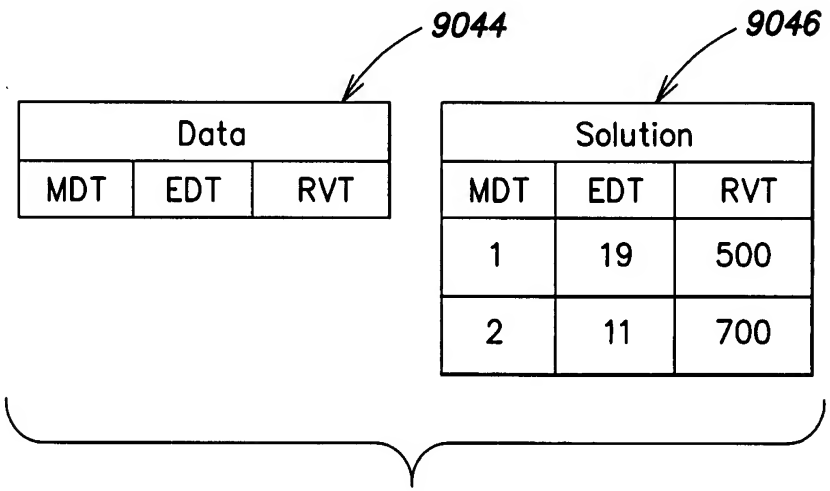

FIG. 24E

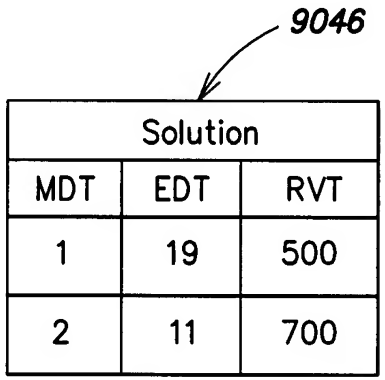

FIG. 24F

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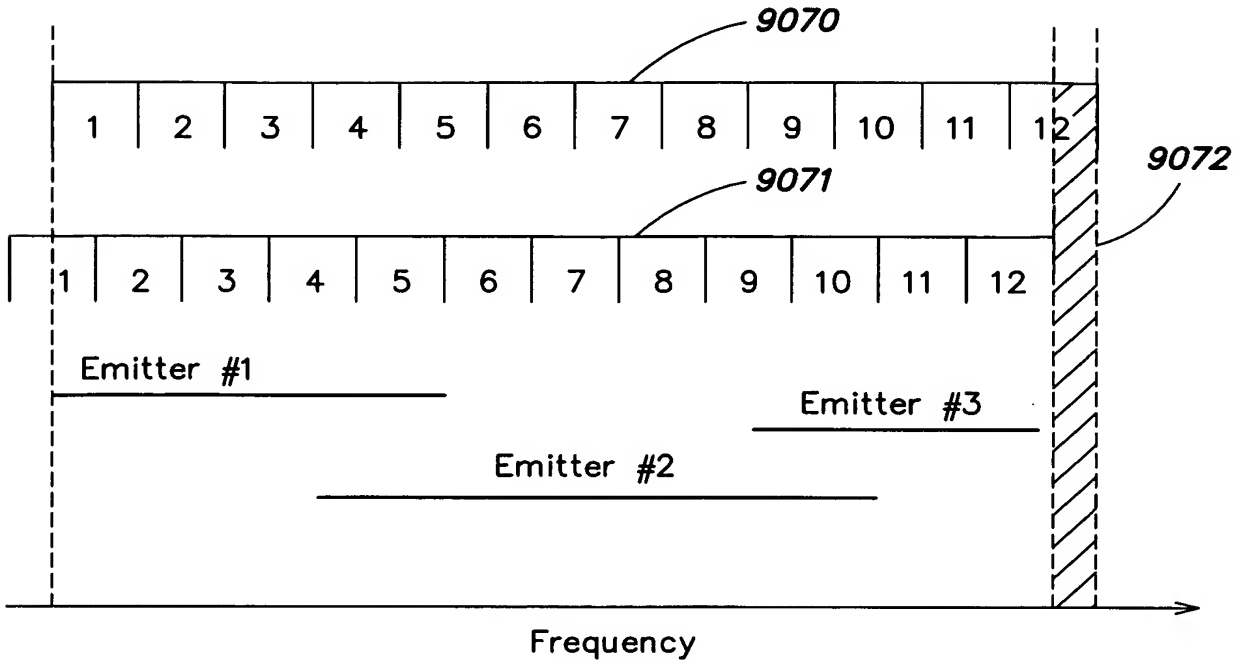
9070
1
2
3
4
5
6
7
8
9
10
11
12
9072
9071
1
2
3
4
5
6
7
8
9
10
11
12
Emitter #1
Emitter #3
Emitter #2
Frequency

FIG. 25

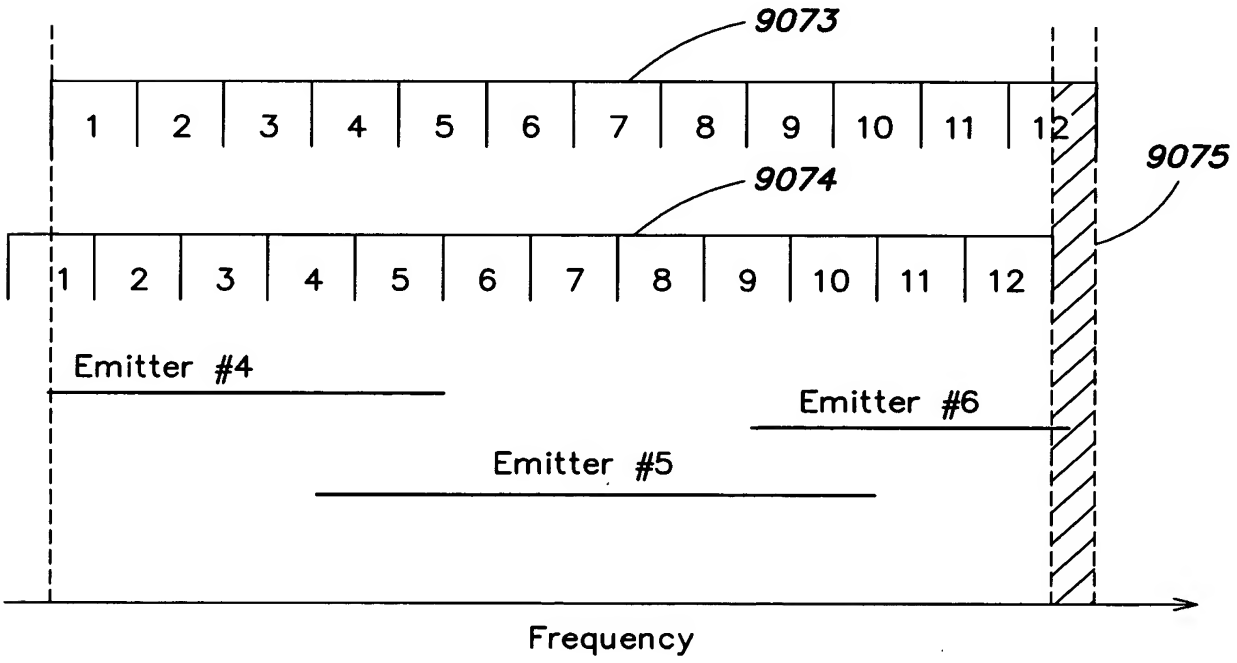
9073
1
2
3
4
5
6
7
8
9
10
11
12
9075
9074
1
2
3
4
5
6
7
8
9
10
11
12
Emitter #4
Emitter #6
Emitter #5
Frequency

FIG. 26

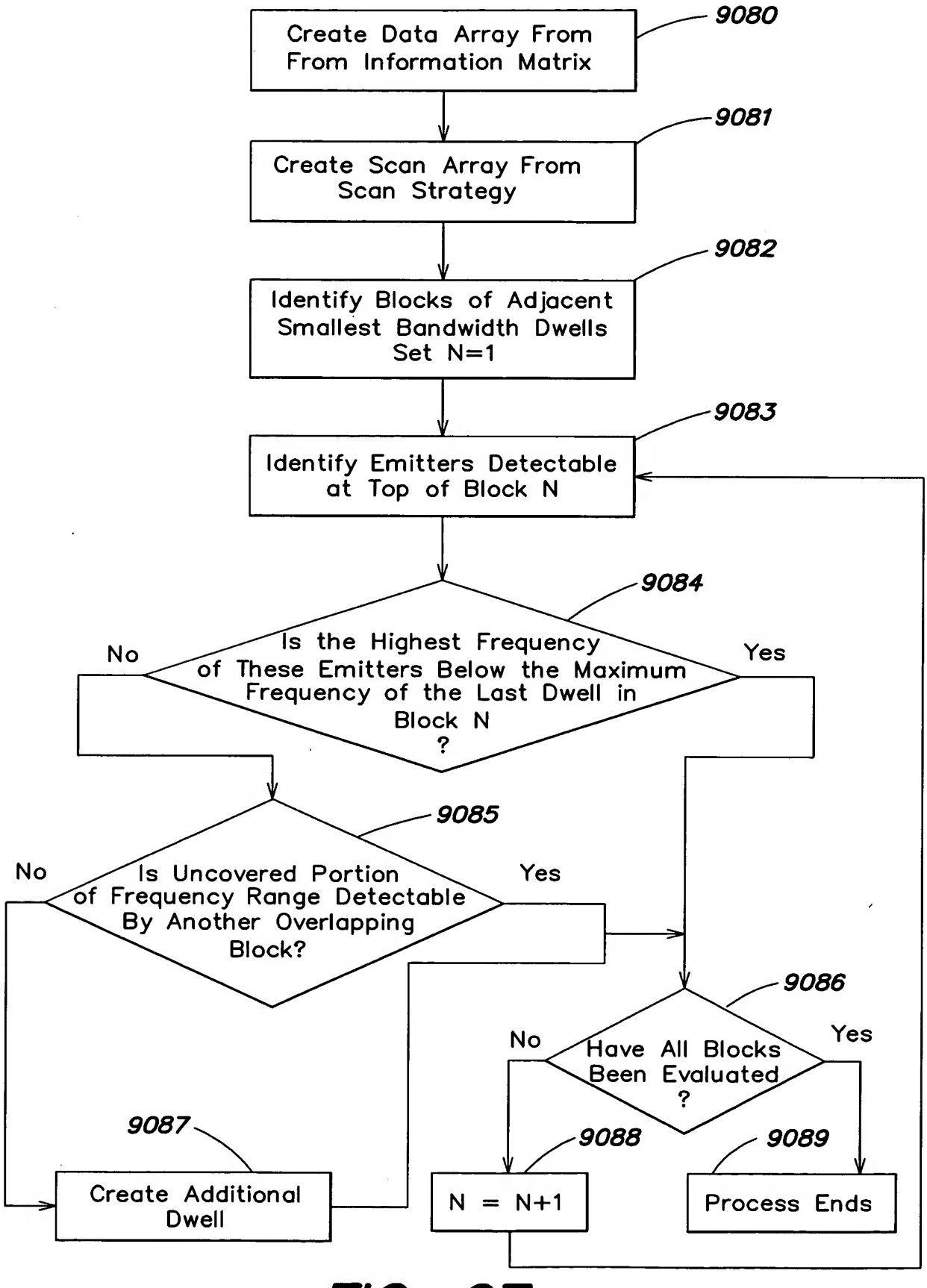
Create Data Array From From Information Matrix
9080
Create Scan Array From Scan Strategy
9081
Identify Blocks of Adjacent Smallest Bandwidth Dwells Set N=1
9082
Identify Emitters Detectable at Top of Block N
9083
Is the Highest Frequency of These Emitters Below the Maximum Frequency of the Last Dwell in Block N ?
9084
No
Yes
Is Uncovered Portion of Frequency Range Detectable By Another Overlapping Block?
9085
No
Yes
Have All Blocks Been Evaluated ?
9086
No
Yes
Create Additional Dwell
9087
N = N+1
9088
Process Ends
9089

FIG. 27

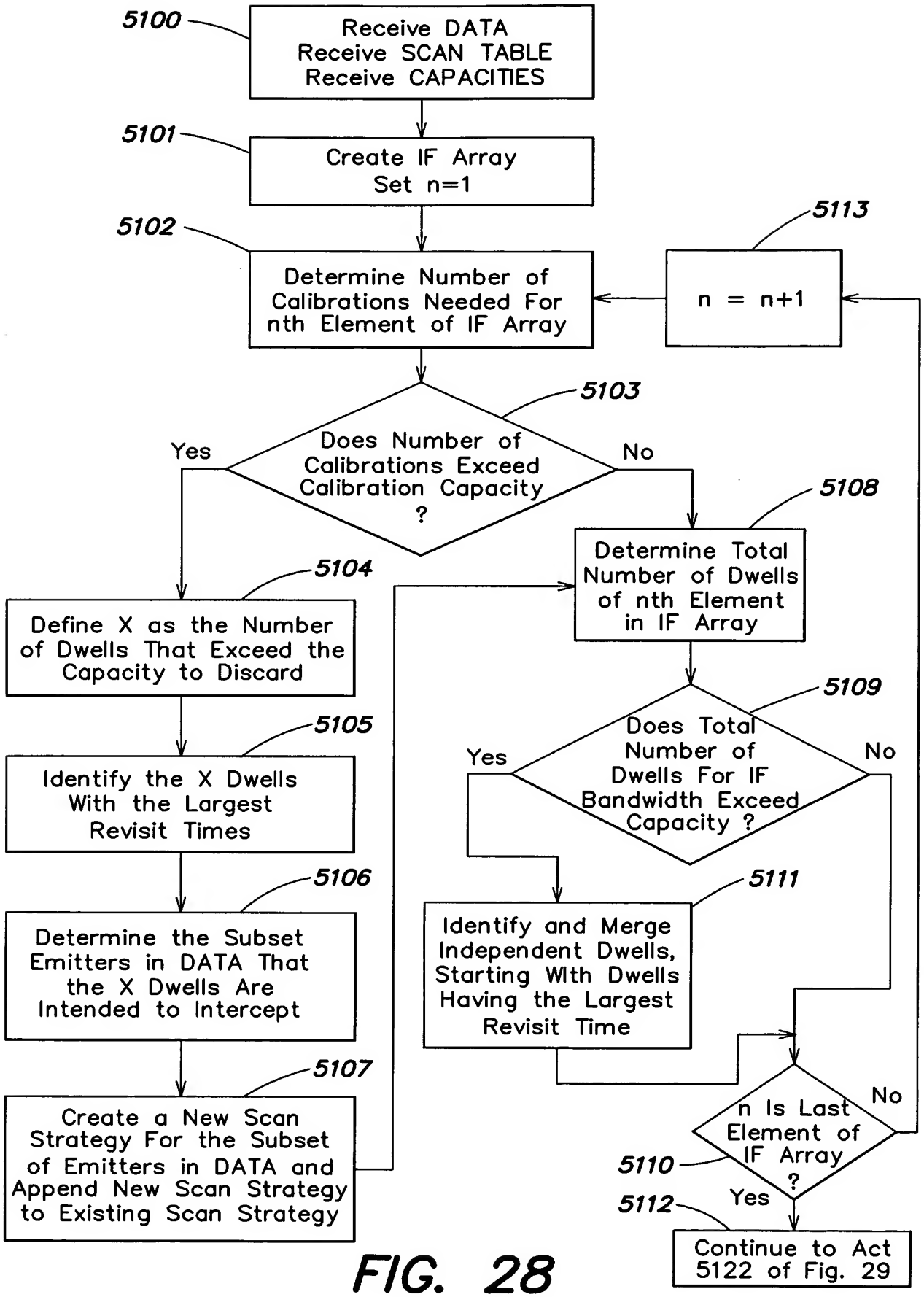
5100
Receive DATA
Receive SCAN TABLE
Receive CAPACITIES
5101
Create IF Array
Set n=1
5102
Determine Number of Calibrations Needed For nth Element of IF Array
5113
n = n+1
5103
Does Number of Calibrations Exceed Calibration Capacity ?
Yes
No
5104
Define X as the Number of Dwells That Exceed the Capacity to Discard
5105
Identify the X Dwells With the Largest Revisit Times
5106
Determine the Subset Emitters in DATA That the X Dwells Are Intended to Intercept
5107
Create a New Scan Strategy For the Subset of Emitters in DATA and Append New Scan Strategy to Existing Scan Strategy
5108
Determine Total Number of Dwells of nth Element in IF Array
5109
Does Total Number of Dwells For IF Bandwidth Exceed Capacity ?
Yes
No
5111
Identify and Merge Independent Dwells, Starting With Dwells Having the Largest Revisit Time
5110
n Is Last Element of IF Array ?
No
Yes
5112
Continue to Act 5122 of Fig. 29

FIG. 28

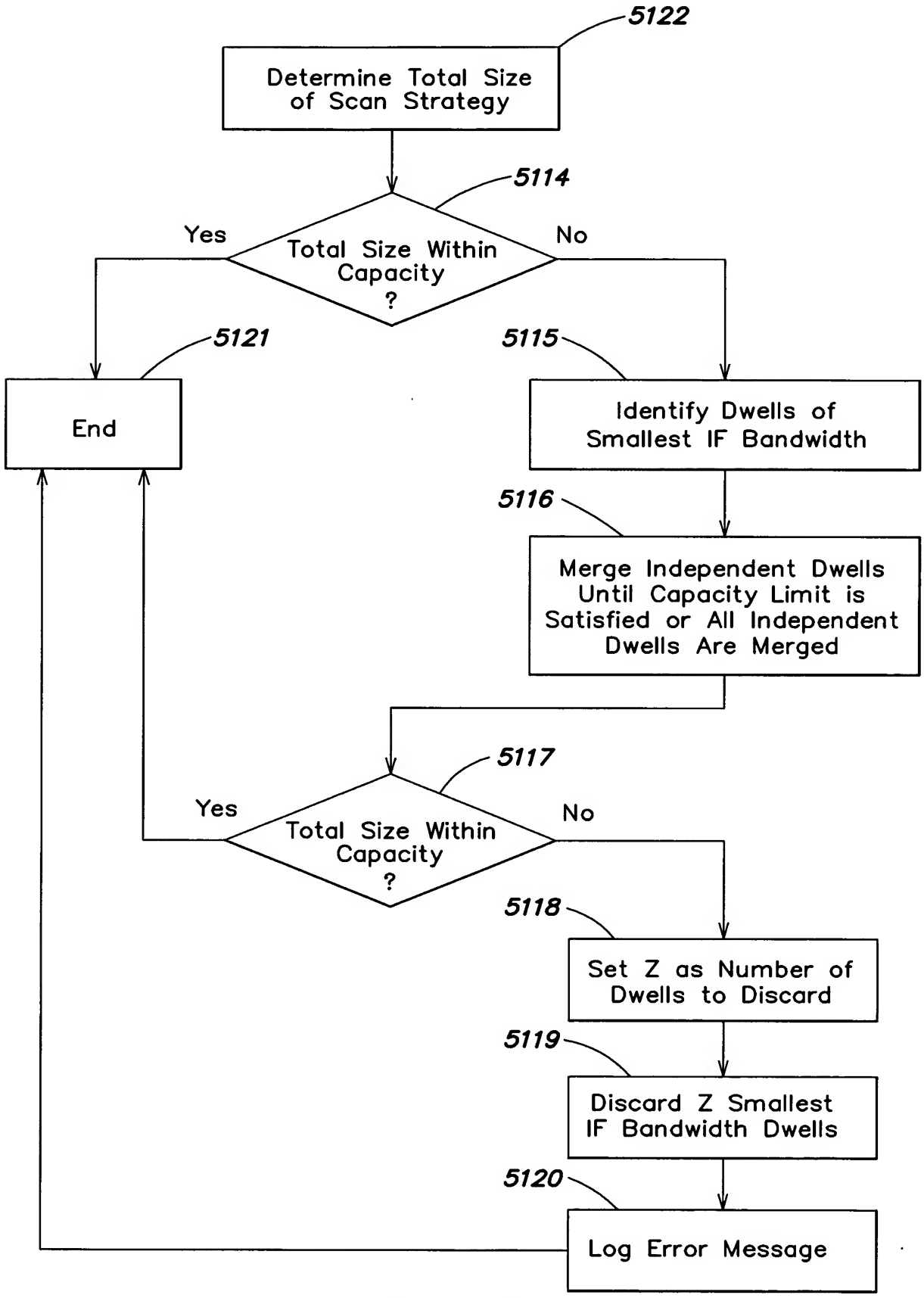
5122
Determine Total Size of Scan Strategy
5114
Yes
Total Size Within Capacity ?
No
5121
End
5115
Identify Dwells of Smallest IF Bandwidth
5116
Merge Independent Dwells Until Capacity Limit is Satisfied or All Independent Dwells Are Merged
5117
Yes
Total Size Within Capacity ?
No
5118
Set Z as Number of Dwells to Discard
5119
Discard Z Smallest IF Bandwidth Dwells
5120
Log Error Message

FIG. 29

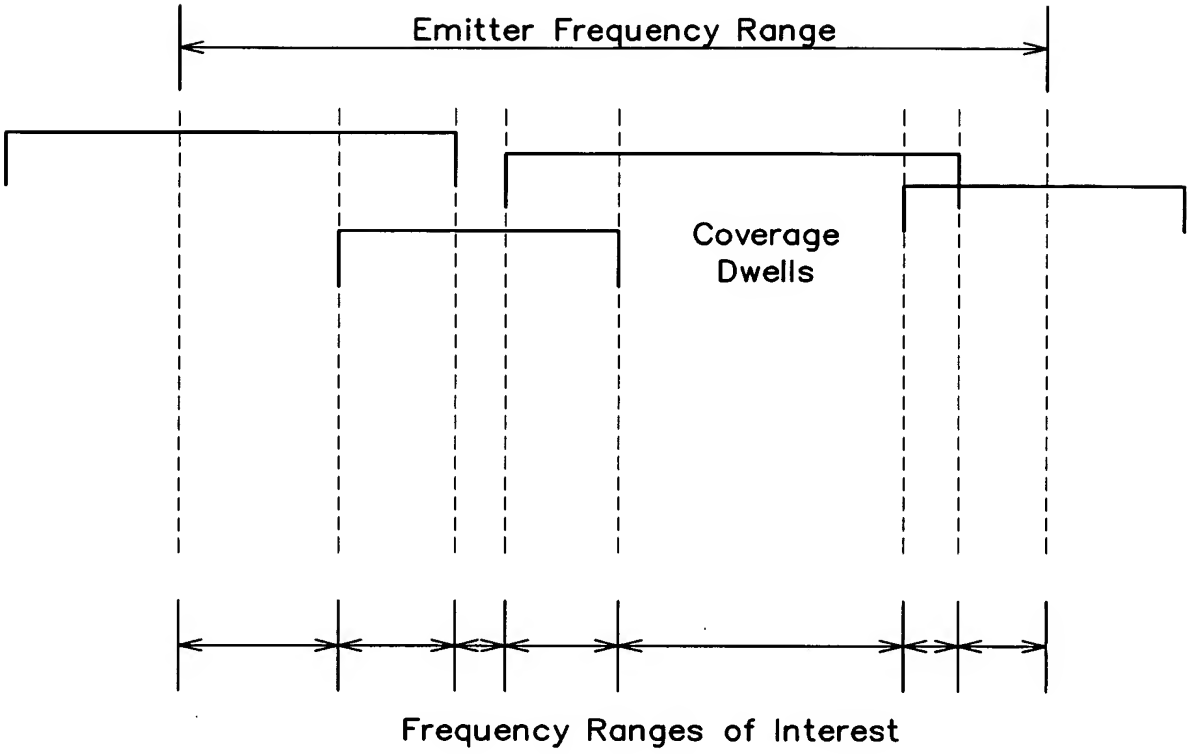
Emitter Frequency Range
Coverage
Dwells
Frequency Ranges of Interest

FIG. 30

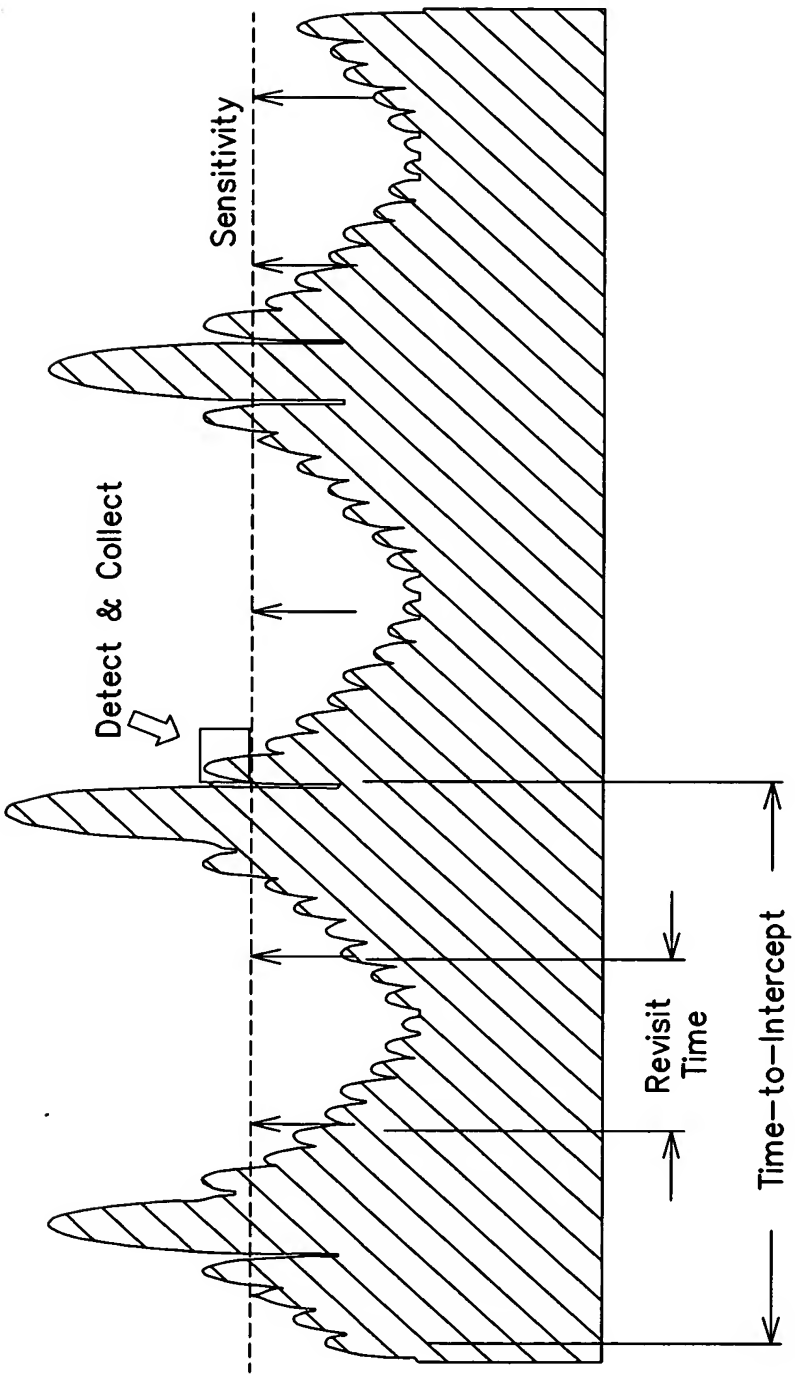
Sensitivity
Detect & Collect
Revisit Time
Time-to-Intercept

FIG. 31

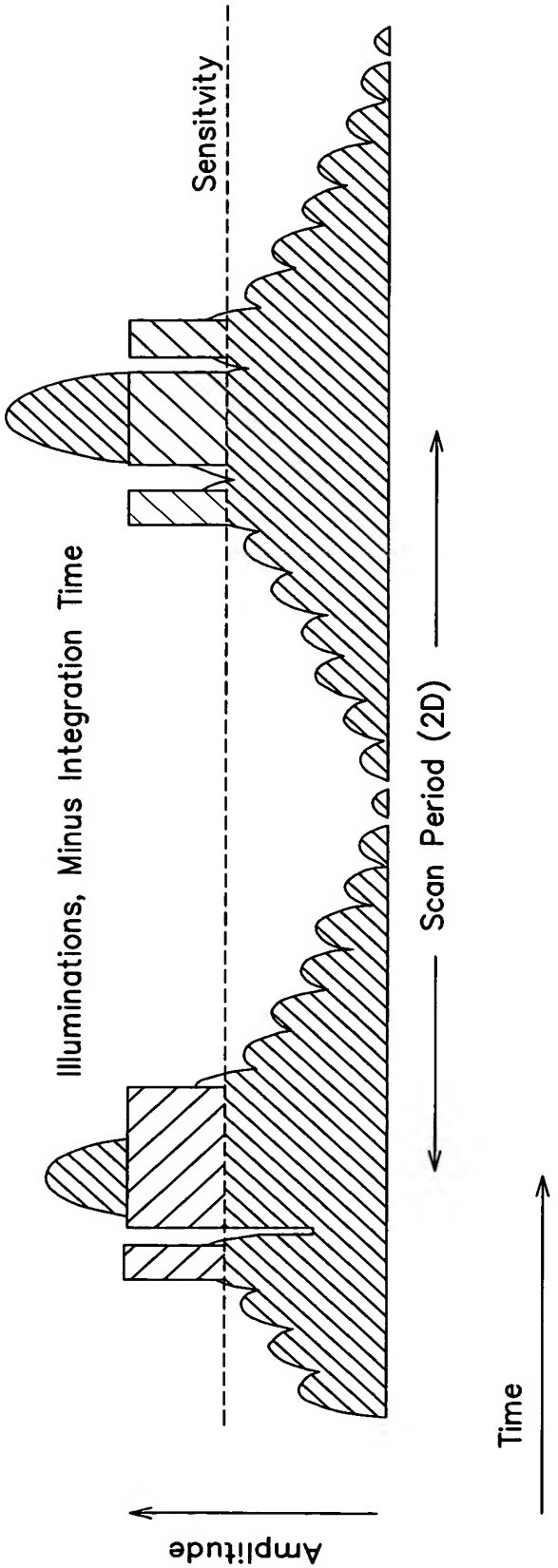
Sensitivity
Illuminations, Minus Integration Time
Scan Period (2D)
Time
Amplitude

FIG. 32